American Engineer

...ional Engineer
...EBRUARY, 1959

Powerful telescopic camera catches rising moon over tree-lined Arizona horizon.

he Engineer at Work:
ıbulous New
ɔncrete Testing
ıboratory. Page 34.

• • •

EE's Report
aluating Work of
C. Page 36.

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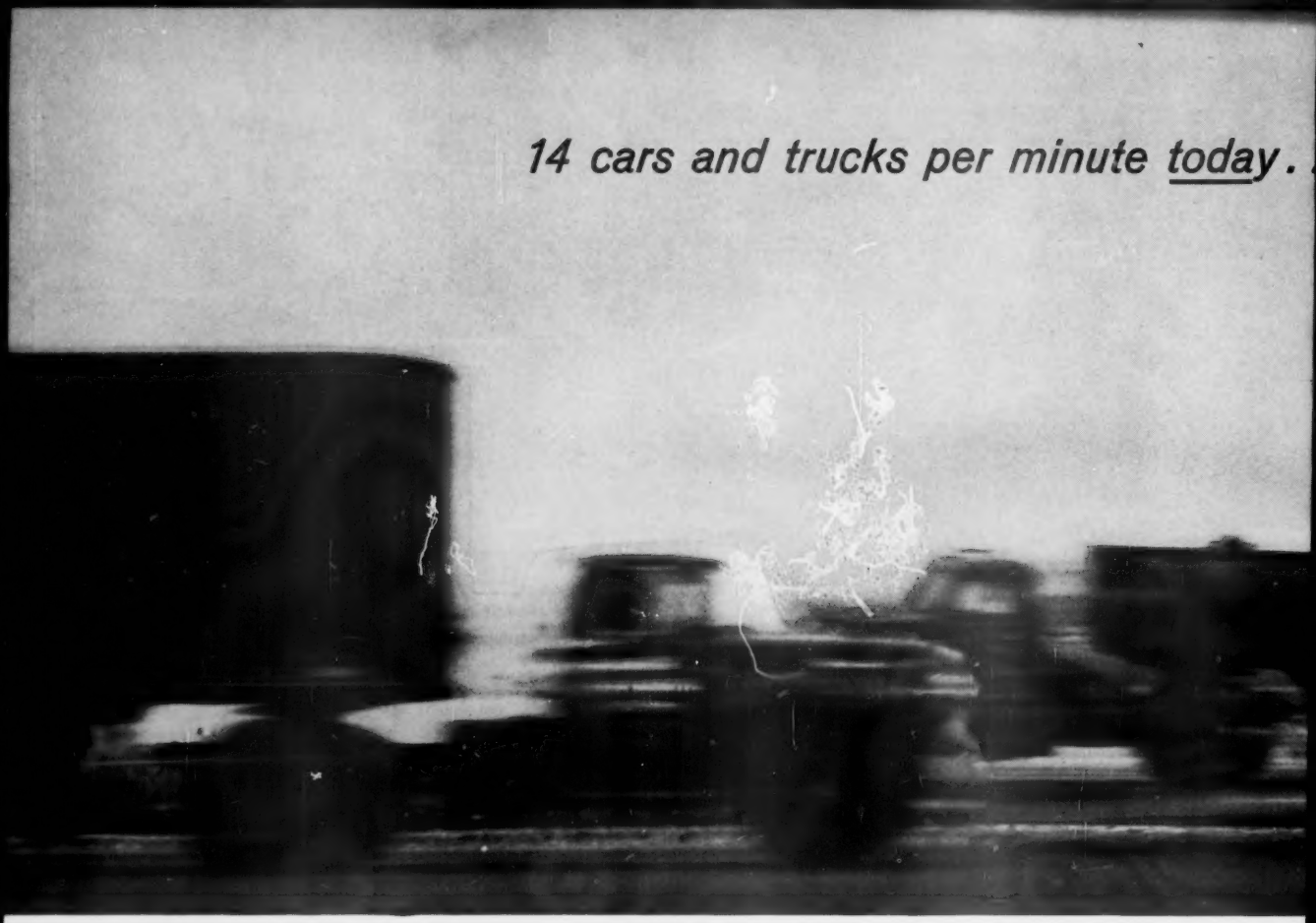
ND News
mpletely Covering
Engineering
ofession!

New survey and mapping methods . . . amazing fuels . . . instrumentation . . . broadcasting techniques . . . solar power:

ENGINEERING, NEW PRODUCTS AND THE SPACE AGE

The U. S. Air Force's new automatic tracking telemetry antenna "shadows" ballistic missiles.

NATIONAL ENGINEERS' WEEK
FEBRUARY 22-28 1959
ENGINEERING FOR THE AGE OF SPACE



Here's one reason why Ohio's

Pounding traffic! Growing traffic volume! Greater and greater axle loads!

These assaults on pavement structures are **not** restricted to the 90-10 Interstate highways. They're common problems faced by engineers responsible for thousands on thousands of miles of road like Ohio's new State Route 73 . . . roads which are to be built largely out of State funds and wholly maintained with these monies.

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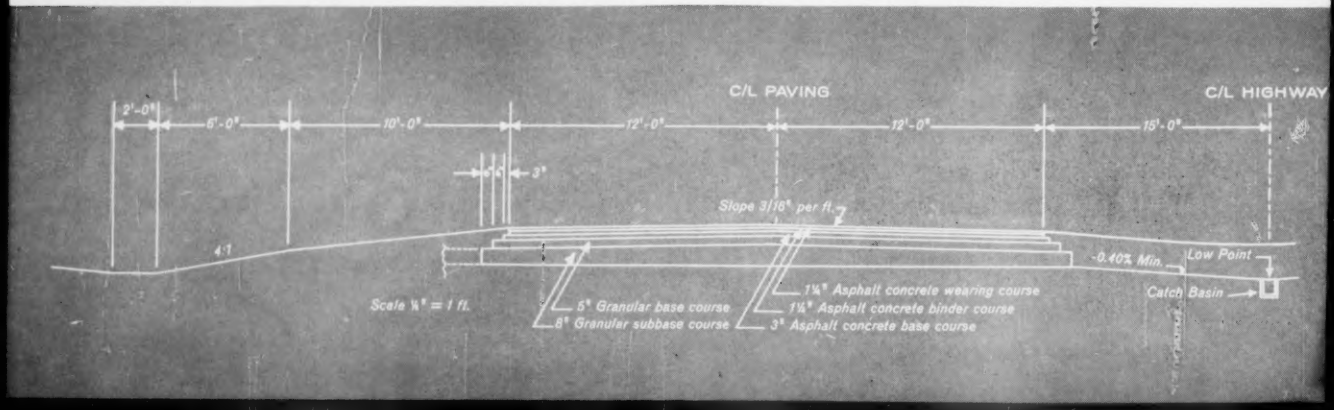
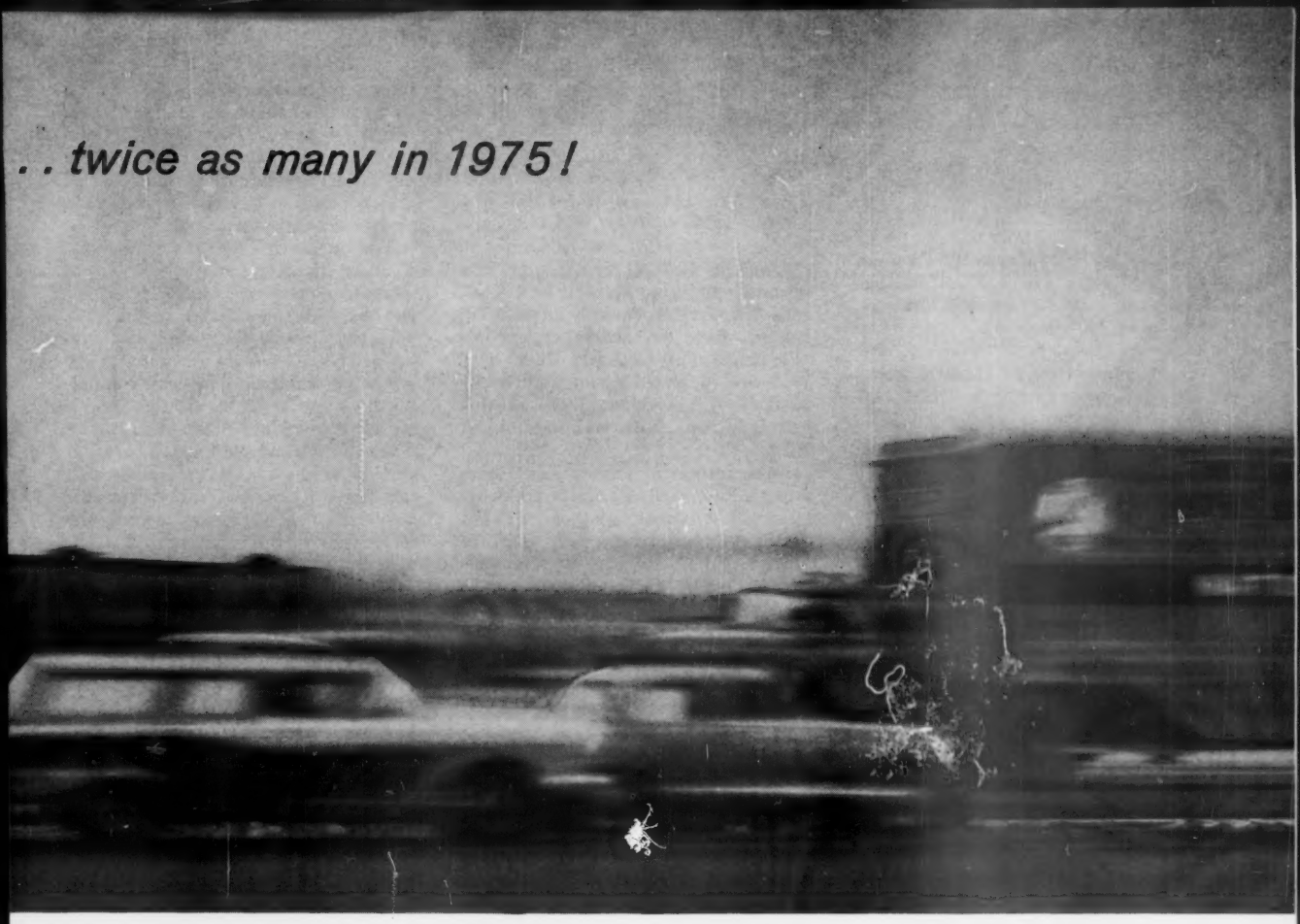
Typical of modern heavy-duty Asphalt sections is this one for Ohio's 5-mile State Route 73 between Middletown and Franklin. Median section is modified to a raised and curbed 15-foot section in urban areas. Pavement must support a heavy traffic of trucks carrying steel, machine tools and other industrial products produced locally. Cost per sq yd for this Asphalt road $3.03; $2.00 per sq yd under the prevailing price for reinforced concrete.



. . twice as many in 1975!



new Route 73 is Asphalt-paved

pavement structures are being built today to handle **any** desired loads with **any** desired built-in durability **. . . and these roads save money.** Cost less to build, less to maintain.

Your State can lay more road for the same money if you design for Asphalt concrete. More road means the traffic load on **all** pavements in your State can be kept at a maintenance-saving minimum.

THE ASPHALT INSTITUTE
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Glacial till in right-of-way favored Asphalt pavement construction. Whenever sub-soil of this type is found it provides excellent natural subgrades for Asphalt paving. Proximity of suitable crusher-run aggregate also favored use of Asphalt on Route 73.

Comfortable! Durable!... because it's modern Asphalt concrete. Notice the smooth-riding, skid-resisting surface. Notice the visibility, too, of the traffic markings on Route 73. With Asphalt concrete, this road sets a standard for quality construction.

Letters to the Editor

Miller Article . . .

Dear Editor:

The very fine article by Professor W. J. Miller: "The Classics of Engineering Literature" in the December, 1958, issue should awaken interest in engineers reading of the work and style of presentation found in early works. Although most of the material published more than a century ago is in foreign languages and unfortunately we engineers, as a class, are not too strong as linguists, there are some fine examples in English which could be added to the author's references.

In 1679, John Evelyn published "Terra, a philosophical essay on Earth" and John Muller in 1755 wrote on "Fortifications;" the two volumes give excellent coverage on theoretical and practical foundation engineering (or we would now call it applied soil mechanics) in clear simple language which cannot be misunderstood. Both volumes appeared in London and are available in the larger American reference libraries. An Italian very early book on Soil Mechanics, 1788, by Paolo Delanges was translated into English by A. J. d'Atri and published in the Brooklyn Engineers Club Proceedings of 1930. If one is interested in soils from an agricultural viewpoint, with considerable data on physical behavior, there are Humphrey Davy's "Elements of Agricultural Chemistry" 1813 and a work by an anonymous Practical Agriculturist entitled "Treatise on Soils and Manures," 1818.

The engineering articles in the London Philosophical Magazine are other examples of clear writing, such as Thomas Tredgold on "Pressure of Earth Against Revetments and Retaining Walls" 1818, vol. 51, p. 401. A paper by the writer published as article I-lal of the 2nd International Conf. on Soil Mechanics (1948) lists 50 technical writings prior to 1835 on this newest of civil engineering divisions.

For one interested in all phases of engineering, reference is made to the volumes published by the Royal British Engineers stationed in Ireland, from about 1840 to 1870. These cover the developments in all engineering fields observed by these engineer officers in every British possession and as technical attaches in foreign lands.

There is a great deal of information as well as example of presentation in these older forgotten contributions.

JACOB FELD, P.E.
New York, N.Y.

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More Dues Needed . . .

Dear Editor:

That NSPE is contemplating an increase in dues is indeed welcome news. There are but few avenues through which an engineer has an opportunity to make an investment in an effort whose aim is to interpret the significance of his profession to the public. This effort is important for as people better come to understand the potentiality of engineering, the better the use that will be made of it and the prestige of the profession will be enhanced.

Minimum professional dues are no more likely to be in a person's best interest than the cheapest professional service, education, or hotel space.

Engineers who are not satisfied with the prestige their profession enjoys with employers and with the public should look upon an increase in dues as an opportunity for them to contribute in behalf of a greater effort towards an end they desire. In the best interest of members, dues should be set at a level that provides maximum benefit to them. This level will certainly not be reached with a three dollar increase or even a doubling of present dues but any increase is a step in the right direction.

The proposed three dollar increase seems a bit cautious when one considers that the present dues of ten dollars are only about two tenths of a per cent of even beginning engineering salaries. Certainly an effort to enhance the profession by which a person lives and earns his livelihood warrants a greater investment than this.

On the basis of NSPE's past performance it is reasonable to assume that the larger its budget, the greater the acceleration of progress toward the recognition of the engineer that we all desire.

H. G. THUESEN, P.E.
Stillwater, Okla.

New AE . . .

Dear Editor:

Congratulations on the big improvement in the AMERICAN ENGINEER beginning with the October, 1958, issue. Along with the new and much improved format and additional very valuable new sections, I feel that the quality of the articles has also improved.

MICHAEL W. WASELL, P.E.
Winston-Salem, N.C.

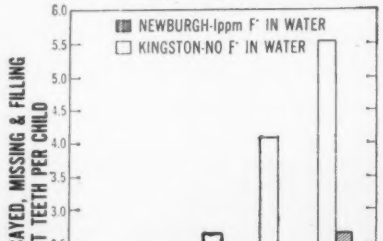
AE in Error . . .

Dear Editor:

January issue, page 21, figure 1—is this chart reversed or am I?

JOE WILSON
Albany, N.Y.

► ***Editor's Note:*** **No, Mr. Wilson, it was our art department that was reversed! Below is shown the chart as it *should have appeared.***



DISEASED, MISSING & FILLED TEETH PER CHILD, AGE 6-10, KINGSTON & NEWBURGH, N.Y., 1953-4

Fig. 1

American Engineer

FEBRUARY 1959
Vol. 29, No. 2

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS
FOUNDED 1934

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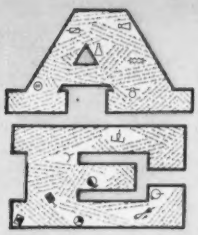


"This Month"

This is our National Engineers' Week issue, commemorating the ninth observance of this amazingly successful public relations effort. (The lawyers recently followed with their own salute to their profession, "Law Day.") The President of the United States has joined in hailing the work of PE's across the land and his special message appears on page 8.

The Week's theme is "Engineering . . . for the Age of Space," and our lead article beginning on page 23 is a comprehensive staff prepared report on "Engineering, New Products and the Space Age." And to show just how important space research and development will become in the years ahead, while the piece was being prepared two news stories broke that dealt with products that will figure importantly in tomorrow's engineering. One hailed the world's first casting of molybdenum which will now be used for rocket parts (melting point: 4,748 degrees), and the other featured yttrium which has been transformed from a brittle to a pliable material. Yttrium has the unique quality of low resistance to the passage of neutrons needed to sustain nuclear reaction. New products to be sure, and you can read all about them in this issue!

"This Month" our "Engineer at Work" is off to Skokie, Ill., to inspect great new things being done by the Portland Cement Association. See page 34 and "PCA Opens 'World's Largest Testing Lab'." And on page 36, more on organizing the engineering profession—this time in the form of a report by the Inter-Society Relations Committee of the American Institute of Electrical Engineers.

Briefing the news columns:

In "Consulting" the AE presents an ably written report on two recent court rulings which tend to extend the engineers' liability. As pointed out in the story, " . . . there appears to be developing a trend to hold consulting engineers and architects liable to third persons, not a party to the engineering or architectural contract, for personal or property damage suffered as a result of the negligence of the professional consultant." Begins on page 11.

In another story, page 17, "Consultants Lose Wage-Hour Case." This is bad news for NSPE and others who have fought a long and hard battle to protect the consultants' interests in this wage-hour matter.

"Government." Reviewing the headlines: Federal Recruitment of Engineers Rises in 1958 . . . Presidents Committee Points to White House . . . Examination Open for Sanitary Engineers . . . and NSPE Space Proposal Listed in House Report.

"Industry." Engineering unions took another beating in Pennsylvania recently with the full story reported on page 19 under the head, "ESA Loses Bid to Represent Utility Engineers in Pennsylvania." This is another defeat for ESA, the last one being in 1957 at Minneapolis-Honeywell. In a related story, a survey by the American Society of Civil Engineers shows that its members are opposed to unions by an 8-2 ratio.

In the back of the book:

NSPE President Clark A. Dunn urges all members to return their ballots which enables them to vote for new officers and on the proposed dues increase, as well.

Kenneth E. Trombley

Editor

THE WHITE HOUSE

WASHINGTON

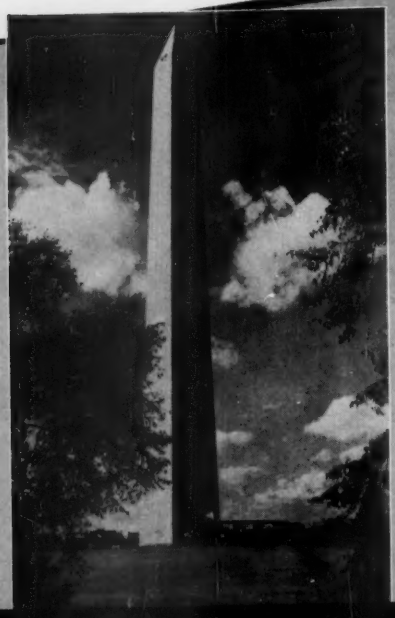
NATIONAL ENGINEERS WEEK

The observance of National Engineers Week provides an opportunity to recognize the vital work our engineers perform in maintaining American superiority in technology. I am heartened by the sense of urgency and public responsibility displayed by American scientists and engineers, and by their determination to be of service to the Nation.

The priority given by engineers and scientists to education is a strong example to us all. Their efforts to alert young people to the importance of careers in science and engineering help to enlarge the basic resources of American intellectual talent. It is only by education that we can guarantee the future supply of leadership in all fields of endeavor.

Dwight D. Eisenhower

Dr. Clark A. Dunn, P. E., President
National Society of Professional Engineers
2029 K Street, N. W.
Washington 6, D. C.



Letter from the President

Many Projects Planned for Engineers' Week, Feb. 22-28

- Major TV Programs to Give Tributes
- Ninth Observance Sponsored by NSPE

"Engineering . . . for the Age of Space" will be the theme heard in programs throughout the country as the 1959 National Engineers' Week, February 22-28, gets underway.

With projects at the national, state, and local chapter levels, professional engineers will conduct career conferences for high school seniors, guided tours through industrial firms and research laboratories, panel discussions on radio and television, and set up exhibits on engineering achievements.

The 1959 observance is the ninth consecutive National Engineers' Week held under the general sponsorship of NSPE. Recognized by President Eisenhower, the governors of most states, and municipal officials in hundreds of cities, the program has become an annual event during the week of George Washington's birthday.

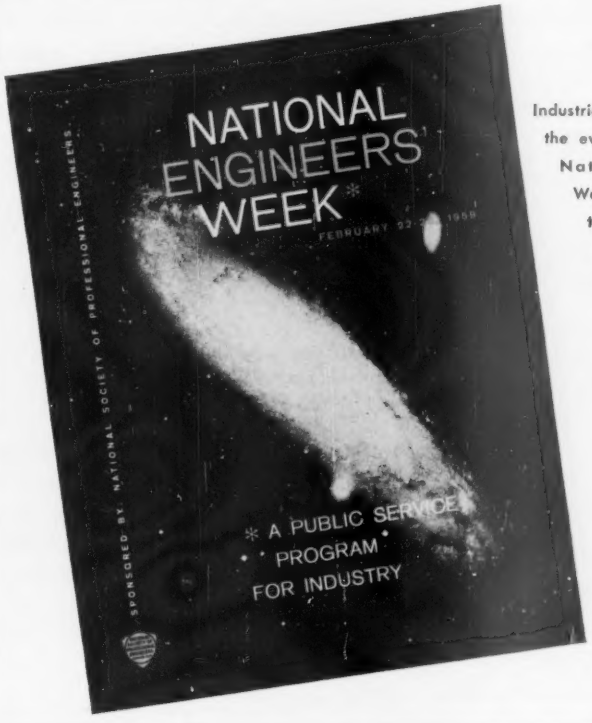
The "space age" theme for the Week this year finds more public attention focused on scientific and technological accomplishments than ever before. Local projects centered around this theme will feature panel discussions, store window and lobby exhibits, and engineering expositions. The technical societies of Syracuse, New York, for example, are presenting a conference under the title of "Engineering in the Space Age." Out in San Diego, the space theme is being emphasized in a 1959 Engineering Exposition. A number of chapters are presenting awards to outstanding mathematics and science students. These awards will be made during programs at which the featured speaker will talk on the engineering contributions to the exploration of space.

Nearly 200 local chapters are showing the film "Mackinac Bridge Diary" to students and other groups during the Week. Produced by the United States Steel Corporation, the film tells the engineering and construction story of the building of the bridge across the Mackinac Straits. Prints of the film were made available to NSPE groups for special Engineers' Week showings.

The National Society's one-minute TV film featuring a tribute to engineers in chemistry will be presented on the Du Pont "Show of the Month" February 24, 9:30 to 11 p.m., EST, CBS-TV. The show will have the Old Vic Company production of "Hamlet." A two-minute salute to the engineering profession will be made on the General Electric Theater, February 22, 9 to 9:30 p.m., EST, CBS-TV. Another major TV network tribute to Engineers' Week will be made on the United States Steel Hour, February 25, 10 to 11 p.m., EST, CBS-TV.

The quantity of promotional material distributed by NSPE for the 1959 Week reflects the continued enlargement of the activities of the program. This material included one-minute TV films, TV slides, tape recorded radio programs, posters, banners, gummed seals, newspaper articles, lapel buttons, and logotypes.

All state society and local Engineers' Week committee chairmen are reminded that complete reports on their chapter activities should be sent to the National Society office as soon as possible. These reports are reviewed by the National Engineers' Week Committee as a source of ideas for the next year's program.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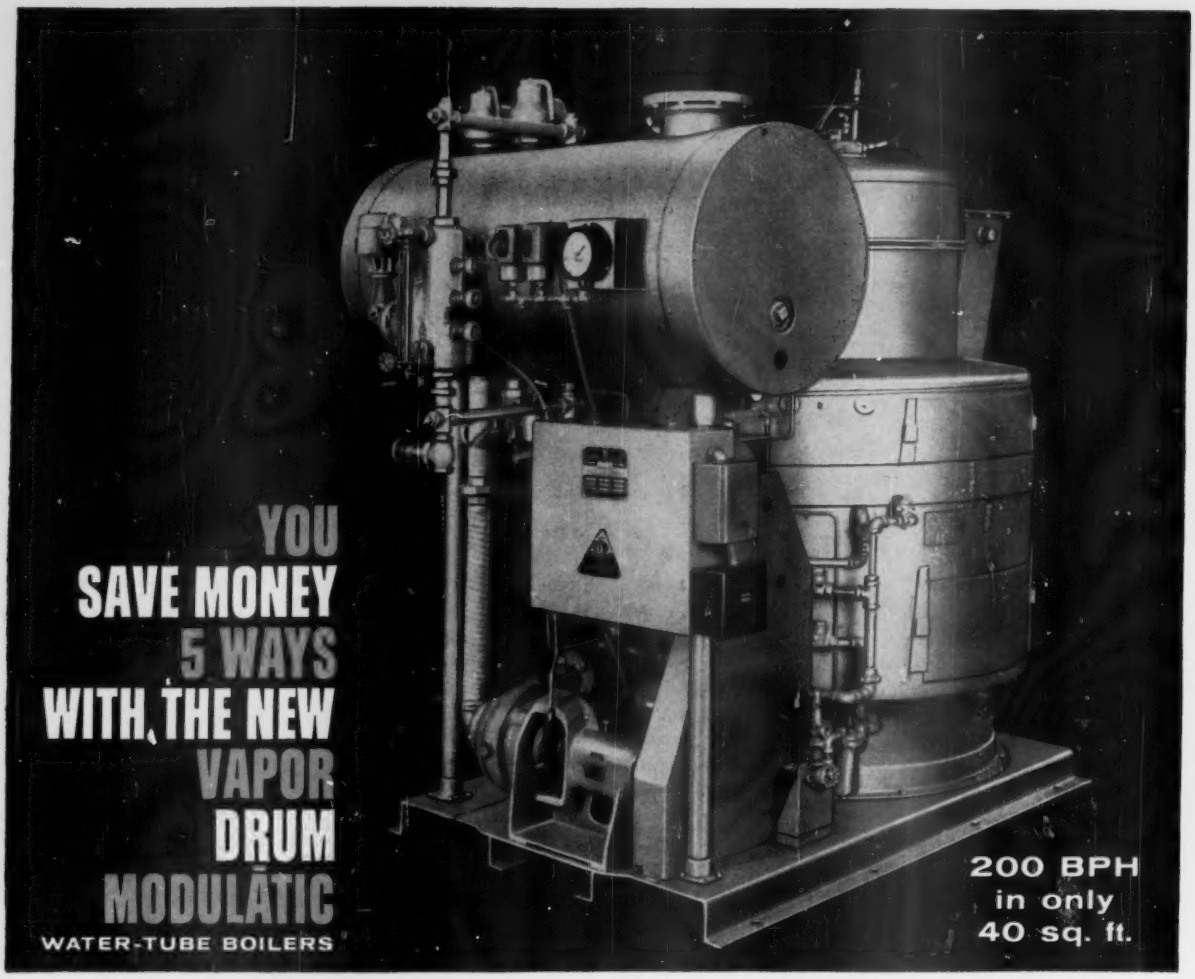

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Court Rulings Extend Engineers' Liability

- Trend Toward 'Third Persons'
- Recent Developments Analyzed

Within recent months, on the basis of two significant court decisions, there appears to be developing a trend to hold consulting engineers and architects liable to third persons, not a party to the engineering or architectural contract, for personal or property damage suffered as a result of the negligence of the professional consultant. Situations wherein engineers and architects have been held liable to owners or other parties engaging them for the rendition of professional services have been litigated for many years, and out of such court decisions there have evolved certain rules and standards pertaining to the degree of skill and ability required of engineers and architects in the performance of their duties. But recent decisions would extend these same standards and requisite degrees of skill to third persons, not parties to the original contract, and hold engineers and architects liable for injuries received by these non-contracting parties.

Before turning to a discussion of this apparant current trend it would be well to review the position of the courts insofar as the liability of engineers and architects to contracting parties is concerned, and to examine standards of skill and ability required. It is for the failure to exercise the degree of skill and ability demanded under the circumstances, that engineers and architects have found themselves on the receiving end of court suits for damages resulting from injury to persons or property.

Simply defined, negligence constitutes the omission to do something which a reasonable man, guided by those ordinary considerations which ordinarily regulate human affairs, would do, or the doing of something which a reasonable and prudent man would not do. Applying this basic definition to engineering and architectural services, a Georgia court, several years ago stated that: "The law imposes upon persons performing architectural, engineering and other professional and skilled services an obligation to exercise a reasonable degree of care, skill and ability, and such care, skill and ability is generally considered to be that which is ordinarily employed by their respective professions under similar conditions and like surrounding circumstances."

However, it is also generally accepted as a valid statement of the law that undertakings by professional engineers and architects does not imply or guarantee a perfect plan or satisfactory results. There is no assurance that miscalculations will not occur. Liability rests only on unskillfulness or negligence, and not upon mere errors of judgment.

Several years ago in Florida an action was filed against a firm of architects for damages allegedly resulting from the architects' negligence and lack of skill in preparing for the owner certain plans and specifications for the construction of two residence buildings. Evidence brought out at the trial showed that certain provisions of the specifications with regard to the manner in which stucco was to be applied were insufficient to make a weathertight job and that leaks actually developed. The architects were exonerated from blame by the lower court, but in reversing that decision the state Supreme Court noted that: "The undertaking of an architect implies that he possesses skill and ability, including taste sufficient to enable him to perform the required services at least ordinarily and reasonably well and that he will exercise and apply in the given case his skill and ability, his judgment and taste reasonably and without neglect."

More recently in Florida the City of Daytona Beach

This analysis and comment *by Stanley H. Stearman, Assistant Legislative Counsel, NSPE, and Member, District of Columbia Bar.*

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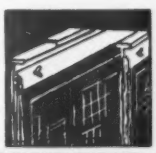

MOMAR INDUSTRIES 4323 West 32nd St. Chicago 23, Ill.

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brought action against a firm of engineers which had contracted with the city for the design and construction supervision of a citywide paving program. The suit was for damages allegedly arising as a consequence of "willful or reckless or negligent" performance of the contract. In its action the city maintained that the engineers had recommended the use of a type of cement that cost two and a half times petroleum cement although not in any way superior in quality; that they had permitted the use of defective concrete pipe and that the plans for the laying of asphalt courses over old brick paved streets had been negligently drawn in that the engineers failed to recognize that such a surface would not be permanent on a base of this sort. In its reversal of the order of the lower court dismissing the action and remanding the case for a re-trial, the appellate tribunal stated: "The engineers owed a duty to their employers to exercise and apply their skills and ability, judgment and taste, reasonably and without neglect."

Many years ago, in a suit before a Pennsylvania court, the essential standards of degree of skill required of engineers and architects was clearly outlined. In that situation a firm of engineers, engaged in the preparation of plans and specifications for iron and steel mills and furnaces, undertook to design plans and supervise construction of a steel plant to be erected in West Virginia. In the engineering contract it was agreed that the engineers would furnish all necessary working drawings for two twenty-five ton basic open hearth furnaces similar to those constructed by them at a plant in New Jersey. According to the complaint of the plant owners, these drawings were so carelessly and unskillfully designed and prepared that it was necessary to remodel the furnaces, thus incurring an otherwise unnecessary and large expenditure. According to one witness at the trial, the plans failed to show ordinary engineering skill in provisions made for fuel combustion, sewers, draft chambers and the construction and use of valves. In essence, the court noted that these engineering services fell far short of the rule that the skill of the engineer should be commensurate with that ordinarily exercised by the engineering profession.

In fact, this Pennsylvania court demanded of these engineers a higher degree of skill than was ordinarily required inasmuch as the engineers had specialized in the design of steel mills and furnaces and had held themselves out as competent to design such structures as shown by their work on the furnaces in New Jersey. "If the work," said the court, "which these engineers contracted to perform had been of an experimental character, or there were underlying it contingencies not subject to control nor likely to be anticipated in the exercise of ordinary skill and care, the view of the trial court that the obligation of these engineers was for the exercise of ordinary skill would have been correct. But the construction of open hearth furnaces was not a novelty nor an experiment."

Furthermore, the court stated that "the employment of these engineers involved something more than merely the production of pictures or drawings. Their work was related to a well established method of steel production for which many open hearth furnaces were then used, and skill with reference to a particular purpose in view was implied in the contract."

Thus in summary it can be seen that professional consulting engineers and architects are held to that degree of skill and ability ordinarily possessed by other members of their profession. However, we have also seen that the degree of skill required may vary under the particular circumstances of each situation. Engineers holding themselves out as specialists on certain engineering matters, and engineers performing services on matters which have been well-developed and tested over the years are usually held to a higher degree of skill and ability than those who do not hold themselves out as specialists in certain fields or who are performing engineering with experimental or untried methods. In other words, specialists are required to maintain that degree of skill and ability possessed and practiced by other specialists; "general practice" engineers are compared to those engaged in performing a variety of engineering services.

All of these situations discussed above have involved suits brought by owners against engineers and architects. We now turn to the recent trend alluded to earlier, the tendency to hold engineers and architects liable to third parties for the engineer's or architect's alleged negligence, *i.e.* the failure to exercise due care and to conform to the required standards of degree of skill and ability in the performance of professional services.

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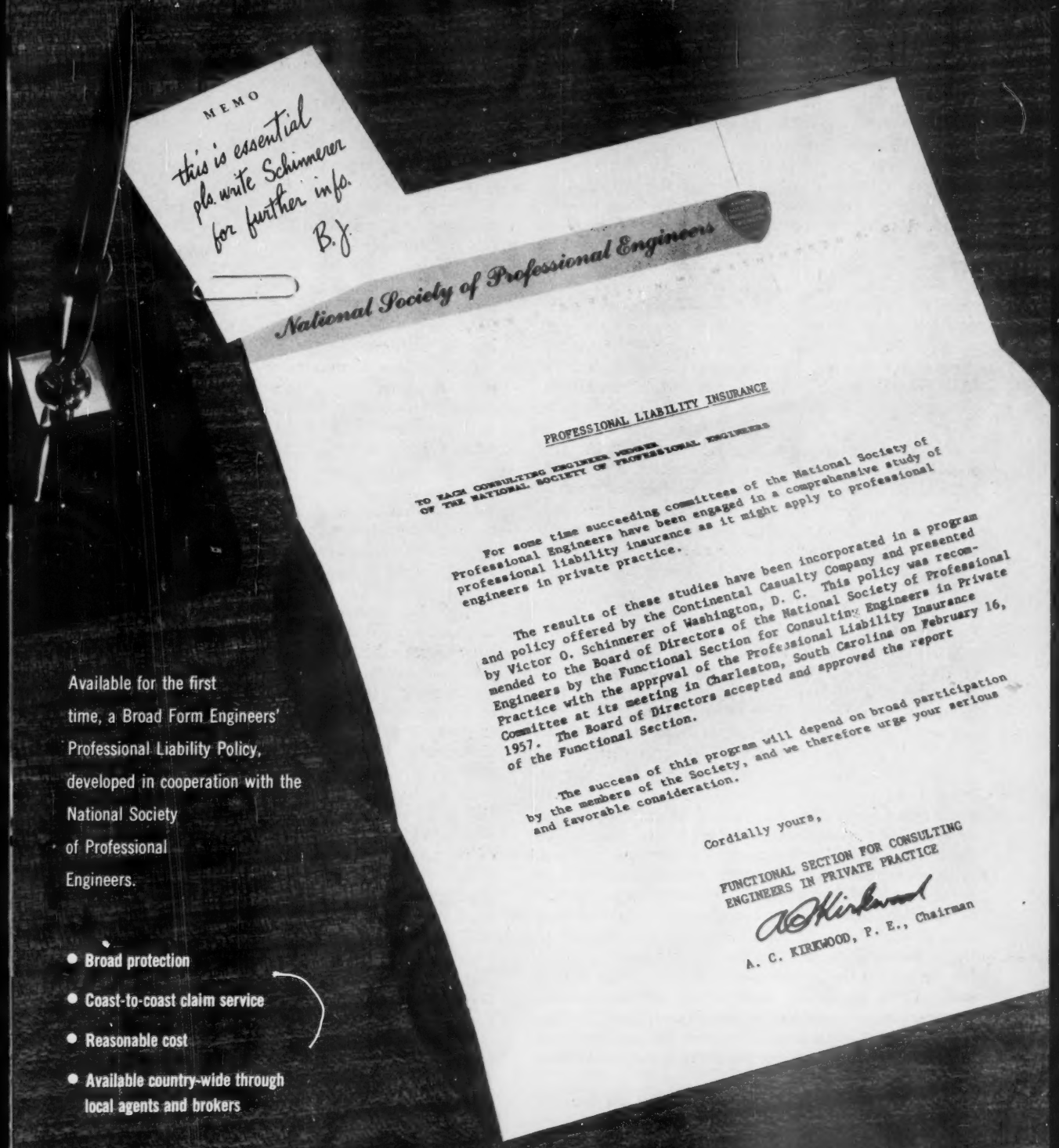
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down a decision awarding damages against an architect and in favor of a third party to the architect's alleged negligence in failing to supervise and inspect the construction of a hot water system. Briefly, the facts in the case were these: A domestic hot water circulating system was installed in a local hospital under a contract between the State of Louisiana and a general contractor. The plans and specifications for this installation were prepared by a registered engineering firm which was retained by the project architect. Prior to the completion of the project, and also prior to the inspection and acceptance of the installation by the architect, the system was fired by employees of a plumbing subcontractor. Approximately thirty minutes later the boiler exploded fatally scalding a plumber's helper. The widow of the deceased then sued the architect along with other parties engaged in work on the project. Court testimony brought out that at the time the boiler was lighted no pressure relief valve, temperature relief valve, or high limit control switch had been installed on the boiler, although these items were called for in the specifications.

In awarding judgment against the architects, the court ruled in essence that the architects were negligent in their supervisory responsibilities, and should have somehow prevented the plumbing subcontractor from firing the boiler until it had been made safe. As for the engineers, it was the court's opinion that since the architect retained a portion of the fee earned on the mechanical work, the over-all responsibility for the job remained solely with the architects, and no liability could be transferred to the consulting engineers.

Conceding that the subcontractor was doubtless guilty of gross negligence in the installation of the hot water system, the court nevertheless held that the architects were negligent in failing to inspect the installation and detect the negligence of the subcontractor and his employees. The court further expressed the opinion that architects are supposed to "snoop, pry and prod" and that if the architects had done that in this case they would have observed the danger in the installation of the hot water system. The court also noted that the architects were not relieved of their responsibility to inspect and supervise simply because they were not called upon by the contractor or subcontractor to make an inspection, but that they were charged with the knowledge that the system was being installed due to the lapse of time between their last action on the matter and the date of the explosion. Thus, for failing to supervise and inspect the construction of a project to the degree found by the court to be required in this instance, the architect was held liable in damages for the fatal injury of a third party.

Latest reports indicate that the architects are appealing this decision to a state appellate court.

A California decision, reported in the October issue of the AMERICAN ENGINEER, held that a supervising architect's negligent breach of his contract with the owner of a construction project gave rise to an actionable claim for damages in favor of a stranger to the contract (in this case a general contractor) who suffered financial injury as a result of the architect's lack of due care. Although the architect in this case claimed that he owed the general contractor no duty to perform the architectural services with any particular degree of care since no contractual relationship existed between him and the general contractor, and that his duty to use due care was only owed to the owner (here the United States) as the party with whom the architect had contracted, the court disagreed and found otherwise. "Considerations of reason and policy impel the conclusion that the position and authority of a supervising architect are such that he ought to labor under a duty to the prime contractor to supervise the project with due care under the circumstances, even though his sole contractural relationship is with the owner, here the United States. Altogether too much control over the contractor necessarily rests in the hands of the supervising architect for him not to be placed under a duty imposed by law to perform without negligence his functions as they affect the contractor. * * * It is only just that such authority, exercised in such a relationship, carry commensurate legal responsibility."

Where does this tendency to extend liability to third parties leave the practicing professional engineer or architect? What can consulting engineers and architects do to protect themselves, or at least minimize their liability to the greatest extent? It would appear that the present tendency is merely an outgrowth of an over-all movement to increase everyone's measure of liability for his own acts of negligence and to award increased damages to those injured. It is generally known that monetary recoveries in personal injury cases have been zooming in recent years to the extent where judgments in excess of $100,000, especially on the West Coast, are no longer uncommon.

Clearly, consulting engineers and architects practice their respective professions at the highest level of their individual skill and ability. They must be diligent and careful, constantly consider and check all angles of every project and do their utmost to see that no facet of the job is overlooked or not planned for. But being only human there is always that possibility of the one fatal slip, more serious than a mere error of judgment and infinitely more costly. In addition, an employer-consultant must, according to the law, assume liability for the negligent acts or omissions of his agents or employees.

With an obvious trend toward greater liability, plus increasing expense incident to any serious lapse of due care or of the required degree of skill and ability, the only apparent solution for consulting engineers and architects is to follow the example of other professional practitioners, contractors, skilled workers and the average citizen: liability insurance. Liability insurance, especially designed for the practicing professional engineer has been available for several years now, and only recently the NSPE Functional Section for Engineers in Private Practice has announced significant improvements in the existing policy. While serious mistakes by profesional practitioners will never be completely eliminated, as they never will in any area of human endeavor, a sound approach dictates that the risk involved be minimized to the greatest possible extent.

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Consultants Lose Wage-Hour Case

In a decision eagerly awaited by consulting engineers, the U. S. Supreme Court, on January 12, 1959, reversed a decision of the Fourth Circuit Court of Appeals and ruled in essence that consulting engineering and architectural services are subject to the provisions of the Wage-Hour Act. In particular, draftsmen, fieldmen, clerks and stenographers employed by the Norfolk-Washington firm of Lublin, McGaughy & Associates were held to be "engaged in commerce" and thus within the Act's coverage, which is predicated upon an employee being either engaged in the "production of goods" for commerce, or "engaged in commerce" itself. The firm's professional employees—architects and engineers—were not involved in this dispute, inasmuch as professional employees are expressly exempted from the Act's provisions.

Chief Justice Warren:

". . . the preparation of the plans and specifications was directly related to the end products . . ."

The case arose when the Wage and Hour Division of the Department of Labor brought an action against the firm to restrain it from allegedly violating the record-keeping and overtime provisions of the Wage-Hour Act. Lublin, McGaughy & Associates perform the usual engineering and architectural consulting services which are typical for a firm of its type. The Government contended that the firm's nonprofessional employees—draftsmen, fieldmen, stenographers and clerks—who worked on the preparation of plans, drawings and specifications, were engaged in the "production of goods for commerce" and that these same employees' interstate activities constituted "an engagement in commerce."

In reversing the decision of the Fourth Circuit Court of Appeals in favor of the consulting firm, Chief Justice Warren, speaking for a 7-to-2 majority, declared that the basic issue before the Court was whether or not the firm's nonprofessional employees were "engaged in commerce." The test used by the courts to resolve this question, he said, is "whether the work is so directly and vitally related to the functioning of an instrumentality of facility of interstate commerce as to be, in practical effect, a part of it, rather than isolated, local activity."

The Chief Justice then followed with this statement, which in effect, constitutes the heart of the Court's opinion:

"Coverage in the instant case must be determined by that test for, as the parties stipulated below, the draftsmen, fieldmen, clerks and stenographers all worked intimately with the plans and specifications prepared by respondent [the engineering firm] for the repair and construction of various interstate instrumentalities and facilities including air bases, roads, turnpikes, bus terminals, and radio and television installations. In our view, such work is directly and vitally related to the functioning of these facilities because, without the preparation of plans for guidance, the construction could not be effected and the facilities could not function as planned. In our modern, technologically oriented society, the elements which combine to produce a final product are diffuse and variegated. Deciding whether any one element is so directly related to the end product as to be considered vital is sometimes a difficult problem. But plans, drawings and specifications have taken on greater importance as the complexities of design and bidding have increased. Under the circumstances present here, we have no hesitancy in concluding that the preparation of the plans and specifications was directly related to the end products and that the employees whose activities were intimately related to such preparation were 'engaged in commerce.'"

In answer to the firm's claim that its activities were essentially local in nature, Chief Justice Warren noted that "Congress deemed the activities of the individual employees, not the employer, the controlling factor in determining the proper application of the Act. Here the activities of the employees show clearly that they are 'engaged in commerce' and thus are eligible for the protections afforded by the Act."

Justices Whittaker and Stewart, in separate dissenting opinions, maintained that the factual evidence in the case did not warrant and support the conclusion that the firm's employees were "engaged in commerce."

NSPE had filed a "friend of the court" brief in the Supreme Court in support of the firm's position. In essence, the Society contended that it was not the intent of Congress, in enacting the Wage-Hour Law, to embrace within its coverage those operations which are concerned with the rendition of a specialized professional service primarily intellectual, creative, nonstandardized and unique in nature.

This decision of the Supreme Court settles a conflict between two Federal Circuit Courts of Appeal on the question of applicability of the Wage-Hour Act to consulting engineering firms. In 1955, the Eighth Circuit ruled in *Mitchell v. Brown Engineering* (see AMERICAN ENGINEER, August, 1955) that the activities of that firm's employees demanded a holding that they were "engaged in commerce." The Fourth Circuit in the instant case, however, held in a comprehensive and lengthy opinion that the employees in question were neither engaged in the "production of goods" for commerce, nor in interstate commerce itself (see AMERICAN ENGINEER, January, 1958).

The full import and significance of the Supreme Court's opinion will be analyzed and discussed in detail by the NSPE Functional Section for Consulting Engineers in Private Practice at the Society's winter meeting this month.

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Government

Federal Recruitment for Engineers Rises in 1958

The Government's improved ability to recruit engineers and scientists during 1958 means there will not be further changes in existing adjusted pay rates for these groups at the present time, according to the U.S. Civil Service Commission. The CSC reported survey findings that the percentage of acceptances to job offers for beginning professional grades (GS-5 and 7) in engineering and science positions had increased from 17 per cent in 1954 to 40 per cent in 1958. By comparison, the acceptance rate for technical personnel offered employment by industry is 46 per cent, the Commission said. On the basis of job offers per student hired in 1958, the Government's rate was 2.5 as compared to industry's 2.2.

Industry still pays a higher average rate and has more flexibility, the Commission said, but the recent increase in Federal rates and the new authority to hire top-quality graduates at Grade 7 have narrowed the gap. Among other factors given for the improved Government situation were continuation of existing special pay rates above base rates for shortage-category positions, intensified recruitment programs and greater emphasis on cordination of recruitment and cooperation with colleges. The new authority to pay travel and moving expenses to first duty stations and the Government Employees Training Act should also help to make it easier to recruit engineers and scientists, the Commission feels.

Presidents Committee Points to White House

The recently-disbanded Presidents Committee on Engineers and Scientists has declared that the White House should take the responsibility for developing Federal policies on engineering and scientific manpower and for coordinating the efforts of Government and private institutions in this field.

Committee Chairman Howard L. Bevis, president emeritus of Ohio State University, said in a report that:

"It is doubtful whether the sudden spurt of public interest (in science and science education) during the past year has created enough conviction about the seriousness of our manpower problem to provide a lasting basis for the formulation and execution of a comprehensive national policy to deal with it."

The AMERICAN ENGINEER will feature an article in the March issue reviewing the three-year work of the Committee.

Examination Open For Sanitary Engineers

A competitive examination for appointment of sanitary engineer officers to the regular corps of the United States Public Health Service will be held in various places throughout the country on April 21, 22, 23, and 24.

The appointments provide opportunities for career service in sanitary engineering, including research. They will be made in the ranks of assistant and senior assistant grades, equivalent to Navy ranks of lieutenant (j.g.) and lieutenant, respectively. Requirements for both ranks are United States citizenship and graduation from a recognized college or university.

Application forms may be obtained by writing to the Surgeon General, United States Public Health Service (P), Washington 25, D.C.

NSPE Space Proposal Listed in House Report

The proposal made by NSPE in February, 1958, concerning the establishment of a national space exploration commission has been listed in a chronology of events in the final report of the House Select Committee on Astronautics and Space Exploration published in January.

The chronology covers significant events relating to outer space during 1957 and 1958. The listing of the NSPE proposal appears as follows:

February 13: The National Society of Professional Engineers proposed establishment of a Federal Space Exploration Commission to undertake and have unified responsibility for a program of space exploration. The commissioners would be appointed by the President, and the civilian commission "would be able to give the military services adequate opportunity for rocket and missile development—as consistent with the defining of service roles at the highest policy level."

Meetings of Note

American Institute of Electrical Engineers—Winter Meeting, February 1-6, Statler Hotel, New York, New York.

American Society for Testing Materials— National Meeting and Committee Week, February 2-6, Penn-Sheraton Hotel, Pittsburgh, Pennsylvania.

American Society of Civil Engineers—National Convention, February 9-13, Hotel Statler, Los Angeles, California.

American Institute of Mining, Metallurgical and Petroleum Engineers—Annual Meeting, February 15-19, Hotels St. Francis, Sheraton-Palace, and Sir Francis Drake, San Francisco, California.

American Concrete Institute—Annual Convention, February 23-26, Los Angeles, California.

Industry

ESA Loses Bid to Represent Utility Engineers in Penna.

The first attempt by Engineers and Scientists of America to secure a new collective bargaining unit since its decisive defeat in the Minneapolis-Honeywell election of May, 1957, has resulted in another major defeat. In an NLRB-conducted election among professional engineers of Pennsylvania Power and Light Company, Allentown, Pa., the union bid was rejected by the engineers 110 to 42. Of 153 eligible voters only one engineer failed to vote.

Following the rejection of their union, the Utility Engineers Association, ESA, filed a petition with the NLRB to set aside the election results and conduct a new election at a later date. The union based its petition on claims that the company's pre-election statements to the engineers had constituted improper action under the permissible limits of campaigning. The union cited company statements regarding individual treatment, financial status of engineer-employees, professional status under union representation, etc., as indicative of an atmosphere which precluded a free choice by the professionals. The company will have an opportunity to submit a reply brief rebutting the union assertions before the NLRB rules on the request for a new election.

Preceding the election, the NLRB ruled on the eligibility of voters, particularly involving the question of supervisory status of certain engineering employees. The union opposed the exclusion of a large number of engineers whom the company contended were supervisory employees and not eligible for collective bargaining representation. The Board found that senior project engineers and project engineers are not supervisory employees because the relationship "is that of a more experienced to a less experienced person," and because their routine merit rating reports on subordinates are considered at higher levels. Also, the Board pointed to the high ratio of those claimed to be supervisors to rank and file employees, which "would be highly disproportionate." On similar grounds, the Board held that senior relay engineers, senior voltage control engineers, interconnection engineers, cost and performance engineers, and local test engineers are not supervisors. However, the lines and substations division engineers were ruled supervisory employees because they are in sole charge of the substations where they are employed.

Technical Writing Survey Conducted

A comprehensive review of the activity of engineers in writing articles and papers, as well as suggestions for engineering managers in organizing and maintaining productive article writing programs, are given in an 8-page study by Harry W. Smith, Inc., technical information specialists.

Reporting the results of a survey recently conducted in cooperation with the editors of *Machine Design* among engineering executives in 170 companies, the study shows how management can encourage technical writing and gives specific ground rules for engineering administrators in establishing sound business policies on such matters as use of company or personal time and payment for published work.

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Eight steps for building and maintaining a technical information program are suggested.

Copies of the report, "Technical Writing by Engineers," are available from the Smith firm, 41 East 42nd St., New York 17.

New Wage-Hour Salary Tests Become Finalized

Effective February 2, 1959, professional and administrative employees must be paid at least $95 a week to be exempt from the minimum wage and overtime provisions of the Fair Labor Standards (Wage-Hour) Act. The previous minimum salary requirement was $75 per week. The new rate for executive employees is $80 a week in lieu of the $55 now required.

The Wage-Hour law exempts professional, administrative and executive employees for the minimum wage and overtime provisions, but leaves the definition of the groups to the Administrator. In addition to a general test, based on the type of work performed, the Administrator has included a minimum salary test over the years. In late 1955 a hearing was held to consider proposals to raise the minimum salary figure and the new figures reflect the results of the earlier hearings. Various unions at the hearings, including the Engineers and Scientists of America, had asked generally for a minimum salary figure of $125 for professional employees. NSPE testified that a minimum salary figure was inappropriate to test professional status, and particularly attacked the discrimination in the regulations which excludes licensed doctors and lawyers from any minimum salary test, but not licensed professional engineers.

The Administrator's announcement of the new salary requirements did not comment further on the reasons for the figures or on his refusal to exclude registered engineers from the salary requirement along with licensed doctors and lawyers. The announcement emphasized that the regulations do not require employers to pay the stipulated salaries to any persons, but if an employee who otherwise qualifies is not paid the minimum salary the exemption will be lost. A special proviso for employees qualifying for exemption under shortened duty tests will be increased from $100 to $125 a week.

Civil Engineers Oppose Unions

A survey by the American Society of Civil Engineers finds increased opposition to unionization of professional engineers. To the question, "Do you consider that collective bargaining is, or would be, advantageous to you," 79.3 per cent said no and 16.4 per cent replied in the affirmative. In 1953 63 per cent said they were opposed to collective bargaining and 37 per cent were not opposed. Of those who answered in favor of collective bargaining, 3,242 of 3,447 would favor a professional group and only 108 a trade union. This group cited economic benefits and working conditions as the major reasons for wanting a union. Only 488 (2.3 per cent) of the respondents are members of bargaining groups. They indicated their membership as 144 in "professional" unions, 145 in trade unions and the remainder in governmental employees groups.

The survey of some 21,000 members disclosed that 64.7 are registered engineers and 14.5 per cent are engineers-in-training. Registration was highest in private practice (76.3), followed by teaching (68.3), Government (62.7) and industry (56.7). In employment, 33.6 per cent were in government, 27.6 in private practice; 31.6 in industry; 5.5 per cent in education.

Figures Released on Engineers in Industry

American industry employed 738,000 engineers and scientists as of January, 1957, (approximately two-thirds of the national total)—528,000 engineers, 152,000 scientists, and 58,000 administrators of scientific and engineering activities. Only one-third of these engineers and scientists were engaged in research and development activities.

These data are contained in a report released by the National Science Foundation entitled *Scientists and Engineers in American Industry—January 1957, Scientific Manpower Bulletin No. 10.* They are some of the preliminary findings from a survey of scientific manpower and of industrial research and development cost recently conducted by the U. S. Bureau of Labor Statistics for the National Science Foundation.

". . . 12:01 we're outa' the bank into the getaway car; 12:35 we meet Slats standing by with a hot space cruiser. Zoom! Away we go, hole up on the moon 'till the heats off."

—Herbert Goldberg in the *Saturday Review of Literature.*

Strictly Business

Personalities . . . **W. M. Watkins, Jr.,** has been named chief process engineer of **Robertshaw-Fulton Controls Company's** Fulton Sylphon Division, Knoxville, Tenn. . . . **Warren K. Brown** has been elected vice president in charge of engineering of **Chemical Linings, Inc.,** Watertown, N. Y. . . . **International Minerals & Chemical Corporation,** Chicago, Ill., has announced the appointment of **H. Turner Loehr** as director of engineering and **Lawrence A. Roe** as director of development . . . **Merrill C. Lorenz** has been appointed director of Public Works of Ventura County, Calif. . . . The appointment of **Col. Wright Hiatt,** USA (ret.), to the vacant post of managing engineer for the Atlantic-Gulf Division of **The Asphalt Institute** has been announced . . . **Frederick R. Einsidler** has been appointed vice president and general manager of **Consultants and Designers, Inc.,** New York, N. Y., it has been announced by **Charles E. Zimmerman,** president . . . **Phil T. Elliott** has been appointed director of the engineering division; **Harold A. Mosher,** associate director; and **Kenneth W. Brenner,** an assistant director, it has been announced by **Ivar N. Hultman, Kodak** vice president and general manager of **Kodak Park Works,** Rochester, N. Y.

Mr. Watkins

J. Todd Murphy has joined the staff of **Telemeter Magnetics, Inc.,** Los Angeles, Calif., as applications engineer in the New York and New England states territory . . . **Frank B. Jewett, Jr.,** has been elected executive vice president of **Vitro Corporation of America,** according to an announcement by **J. Carlton Ward, Jr.,** president . . . **Houghton R. Hallock,** recently retired as colonel from the U. S. Army Corps of Engineers, has joined the consulting engineering firm **of Gannett Fleming Corddry and Carpenter, Inc.,** in Harrisburg, Pa., as director of the General Engineering Division . . . **Albert Musschoot** has been appointed director of research and development for **Carrier Conveyor Corporation,** Louisville, Ky. . . . **Robert Archer,** a member of the faculty of New York State University's Technical and Agricultural Institute, has joined **Greer Hydraulics, Inc.,** Jamaica, N. Y., as a development engineer . . . The promotion of **Richard C. Niblack** from chief designer to director of design has been announced by **Charles Luckman Associates,** planning-architectural-engineering firm of Los Angeles and New York . . . **Dr. R. Curtis Johnson** has joined the technical staff of **The Thompson-Ramo-Wooldridge Products Company, Dr. Montgomery Phister, Jr.,** director of engineering, has announced.

Mr. Hallock

Lawrence H. Peden has become an associate in the firm of **Jack M. Lyerla,** Consulting Structural Engineer, Spokane, Wash. . . . **Metcalf & Eddy,** Boston, Mass., announces the admission to partnership of **Andrew C. Paton** . . . **Emil Spinden,** vice president and chief engineer of **Sika Chemical Corporation,** Passaic, N. J., retired December 31, but is continuing to serve the company as a vice president and consultant . . . **J. K. Gannett** has retired after forty-three years with **The Austin Company,** Cleveland, Ohio, and fifteen as its vice president in charge of all engineering and research . . . **Dr. J. Earl Thomas** has joined the engineering staff of the Semiconductor Division of **Sylvania Electric Products, Inc.** . . . **Daniel M. Roop** has announced that he is now actively engaged as a professional engineer offering consulting services in hospital design and engineering management in Memphis, Tenn. . . . The appointment of **Stanley C. Killian** as vice president and general manager of the **Delta-Star Electric Division, H. K. Porter Company, Inc.,** has been announced by **C. L. Holbert,** president.

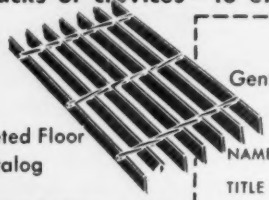
Mr. Gannett

NICAD Division of **Gould-National Batteries, Inc.,** Easthampton, Mass., has announced the appointment **of Fayette C. Anderson** to their engineering staff . . . **John H. Ingalls** has been appointed a field service engineer in **A. M. Byers Company's** Boston, Mass., Division . . . **James M. Hastings** has been named a partner in the consulting engineering firm of **Ketchum & Konkel,** Denver, Colo. . . . The appointment of **Warren G. Burres** to the position of district engineer of the **Portland Cement Association's** Los Angeles Office has been announced . . . **Phillips Eastman, Jr.,** has been appointed manager of the Denver, Colo., facility of **Hallamore Electronics,** a division of **The Siegler Corporation** . . . **Dr. Frank J. Lavacot** has been appointed director of research and development for **McCormick Selph Associates,** Hollister, Calif. . . . **Edward J. Warner** has joined **Spectra Electronics Corporation,** Mt. Vernon, N. Y., as manager of applications engineering, and senior systems analyst. The **Spectra** organization is a newly-formed division of **Douglas Microwave Company, Inc.** . . . **Jack H. Zillman** has been appointed general manager of **Daystrom Pacific,** Los Angeles, Calif.

Mr. Hastings

Q. Where can I find an inexpensive, light, fireproof, completely ventilated flooring?

A. BORDEN ALL/WELD floor grating in this installation furnishes all the above features — PLUS — it is self-cleaning and Borden All/Weld floor grating is solidly welded without cracks or crevices — to eliminate corrosion.



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(Circle 6 in Readers' Service Dept.)

American Engineer

ENGINEERING, NEW PRODUCTS and the SPACE AGE

Space travelers will be few and far between, but creative engineering in space projects will bring about world-wide TV, electronically controlled automobiles, new light metal alloys, powerful chemical fuels, and long-range weather forecasting.

By **JOHN T. KANE**
American Engineer Staff

EARTHMAN is on the brink of becoming "solar system man," and, if the optimists prevail, he is not too far from pushing his ever-widening horizons right up to the stars and beyond.

Satellites orbit the earth, a new planetoid has been added to the sun's gravitational family, and the moon is right now a target for a number of impending rocket probes. Once merely a fantasy of wishful hoping among a tiny band of space enthusiasts, the exploration of outer space has today become the highest priority item in national defense budgets and in industrial and scientific research. From an engineering point of view, the exploration of our solar system represents the greatest challenge the profession has ever faced. Indeed, it is by now apparent that man's conquest of outer space is, and will continue to be, based solidly on engineering achievements--achievements that have already

generated new approaches in a considerable segment of our industrial technology and give promise of a remarkable harvest of new processes and products within the next five to ten years.

Budget estimates call for the United States to spend something like $7 billion for missiles and space projects during 1959. If Congress revises this spending program, it will almost certainly be upward. In the light of statements by Russian scientists concerning an ambitious and organized Soviet program for exploring the surface of the moon, it is equally certain that Congressional pressure will push spending for space projects alone to well over the less than $1 billion figure which the Administration apparently has budgeted for this year. Outer space has suddenly become the most expensive real estate our tax money can buy.

Less than twenty-four hours after President Eisenhower's State of the Union Message at the opening of the Congressional session in January, the House Select Committee on Astronautics and Space Exploration released a report carrying the statement that the U. S. faced "national extinction" unless it undertook a bold and dynamic program to surpass the Soviet Union in the race into space. The attitude of the Congress toward a $7 billion missile and space outlay is indicated in the Space Committee statement that "budget pressures in the short run should not be the primary basis for decisions on space programs which are inherently long-range and which involve the very survival of the nation."

How deeply are America's engineers involved in this multi-billion dollar, "inherently long-range" activity, and what can the public expect to get back on its investment in the way of new things and better ways to do things?

The answer to the first of these questions is, to a certain degree, displayed before the public each day in newspaper classified pages. It is in this torrent of printed matter soliciting the attention of engineers that the public conception of the "engineering shortage" is probably built up most effectively. All during the recession of 1957-58—while engineers were laid off throughout industry—these insistent "engineers wanted now" ads appeared.

As 1959 gets underway, the advertisements have increased in number and size. A recent Sunday issue of *The New York Times* carried twelve full pages of display classified ads for engineers and scientists. Advertising agency artists must have by now utilized every possible graphic illustration of an outer space theme to attract attention to their clients' "growth possibilities," or to "climate and recreational opportunities."

Here are the specialized engineering fields which are called for over and over again in the space and missile industry ads: space technology, computer development, systems analysis, microwave, infrared, transistors, pulse circuitry, antennae & propagation, magneto-hydrodynamics, inertial navigation, semi-conductors, solid state development, cryogenics, electronic packaging, nucleonics, and miniaturization.

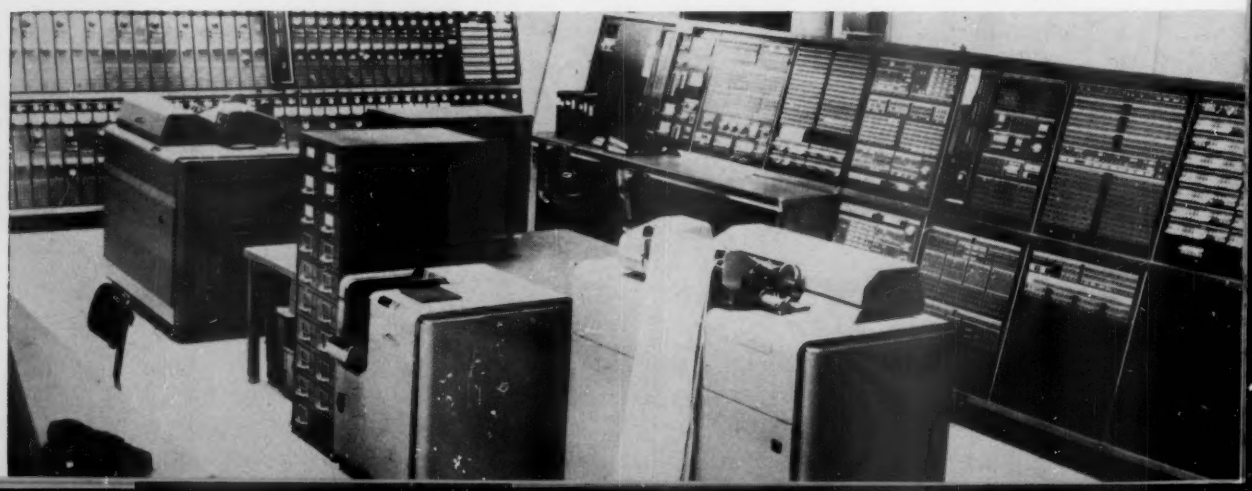
The need for engineers expressed in these classified advertisements is real and specific. In missile and space projects, engineers have more and broader career opportunities in industry, government, education, private practice, and the military than in any other technological area. These opportunities are numerous today and will increase exponentially as our $7 billion investment is increased.

It should be emphasized, however, that engineer recruiting ads must be given a close second look if a true picture of engineer need and involvement in the space age is to be obtained. Out of 100 random "engineers wanted" ads examined by the American Engineer staff, fully eighty-five per cent were asking either for graduates right out of school, or for engineers with five to eight years intensive experience in space technology fields. The phrase "senior engineer" appeared in seven out of ten ads. Approximately twenty-five per cent of the firms were seeking men with up to ten years experience in the specialty outlined in the ad.

From this analysis, and from interviews with engineering personnel managers, it is clear that the biggest recruitment effort is centered around attracting the members of the relatively small nucleus of highly experienced engineers with up to ten years experience behind them in space and allied projects.

"We have a definite shortage of engineers in antenna design," reported one personnel executive in the American Enginfer survey. Additional questioning brought out

Complex missile and space satellite projects have stimulated the development of data processing centers and computer units. Navigation problems involving several celestial objects and trajectories through several hundred thousand miles of outer space call for an ever-increasing sophistication of computer circuitry.



the fact that this firm, a large electronics defense contractor in the Washington, D.C., area, needed engineers with at least five years experience in the design of complex tracking antennas, probably satellite or missile tracking types. How many engineers were working on advanced missile or satellite tracking five years ago?

A major electronics firm is currently advertising its "exceptional opportunities" for engineers. The fine print, however, calls for engineers with "at least three years experience in the design of new microwave systems, tropospheric scatter systems, ridge waveguides, and other novel microwave devices." Not too many non-engineering readers of this advertisement would recognize that "novel microwave devices" have developed under the impact of the space projects to an extent all out of proportion to progress in other conventional industrial areas, with a consequent gap between qualified engineers and professional opportunities.

Another factor that contributes to public confusion over the engineering manpower situation is the industry-wide practice of lumping personnel needs for engineers, physicists, mathematicians, and other scientists in the same help wanted advertising. In a recent 10-page advertising section in *The New York Times* for engineers and scientists, seventy-five per cent of the ads also asked for physicists, and slightly less than fifty per cent of the ads also asked for mathematicians. It is, in fact, in theoretical and applied physics and mathematics where the most critical manpower need is in the more advanced space and electronics programs.

Increasing industry requirements for graduate study—up to the doctorate degree—for engineer job applicants in space projects further underscores the truism that what industry is actually so short of is a steady supply of engineers with a Ph.D. academic background who are able to work at the research scientist level. The diffusion of boundaries between engineers and scientists in recent years is particularly noticeable in missile and space exploration teamwork. In some missile, guidance, and instrumentation programs, it is quite difficult to separate the research engineers from the physicists on the basis of job description alone.

The great opportunity potential for engineers in the space age lies in the enormous size of missile and space exploration research and development. Even within the engineering profession, many individuals have not yet realized the magnitude of our missile and space activity in terms of industrial participation. The multi-stage Atlas ICBM which hurled America's largest satellite into orbit, had 1,209 companies behind it as primary suppliers. These firms are located in thirty-two states, and have supplied raw materials, parts, equipment or special services for the Air Force missile.

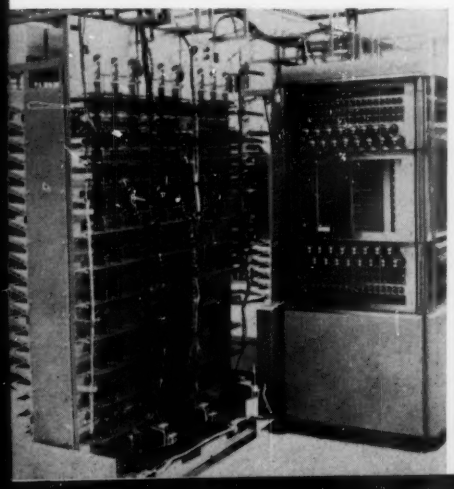
According to J. R. Dempsey, vice president of Convair Astronautics Division of General Dynamics Corporation, prime contractors for the Atlas, "if an over-all total could be compiled, we would expect it to show that more than 5,000 firms are participating in development of the Atlas weapon system as primary or secondary suppliers." Convair statistics show that $90 million was paid out in 1957 to firms in 344 cities as the Atlas went into final development.

To the Atlas, of course, must be added the industry and military work on the whole family of other major U.S. missile projects—Jupiter, Redstone, Polaris, Thor, Titan, Juno—an arsenal of smaller military missiles, the rocket aircraft X-15, the new heavy rocket engine contracts authorized by the National Aeronautics and Space Administration, and a growing assortment of still classified projects for earth and lunar satellites, manned satellites, outer space vehicles, electronic deep space propellants, Mars and Venus probes, solar probes, atmospheric re-entry projects, and so forth.

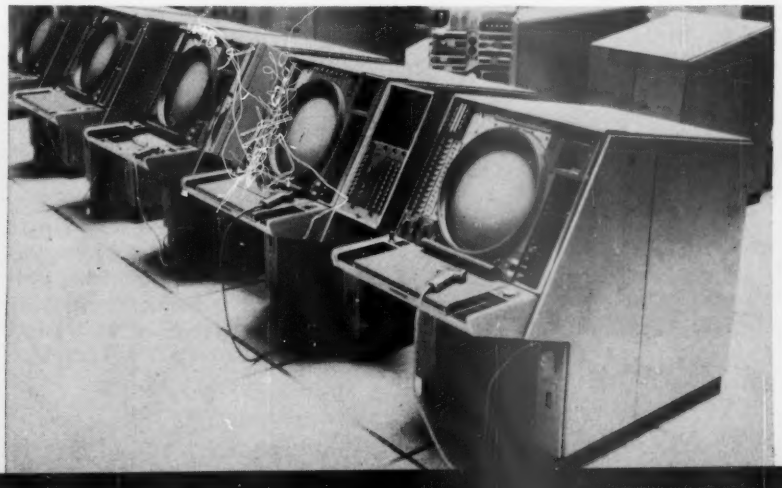
As short a time as five years ago, many industry people viewed the missile and space business as merely an extension of the aircraft industry, with big defense contracts going primarily to the large manufacturers. But in those five years, the impact of missile weaponry and space exploration has been felt throughout industry. Engineering "break-throughs" have, in point of fact, made nearly all predictions of space age industrial expansion turn out to be far too conservative.

The president of the American Rocket Society, George P. Sutton, predicted at a recent meeting of the Society in Detroit that space flight alone would be a $4 billion industry, employing 500,000 within fifteen years. If Mr. Sutton's prediction is only fifty per cent optimistic enough—a good rating in the space

Electronic devices are extending man's own cerebral mechanism out into space.



The impetus given to the electronics industry by engineering breakthroughs in missile and space exploration programs will be felt for years to come.



business—then we can soon expect to have more being spent on space exploration than is now going into the entire military missile program, with a corresponding increase in engineering involvement as Earthman moves out into the depths of the solar system.

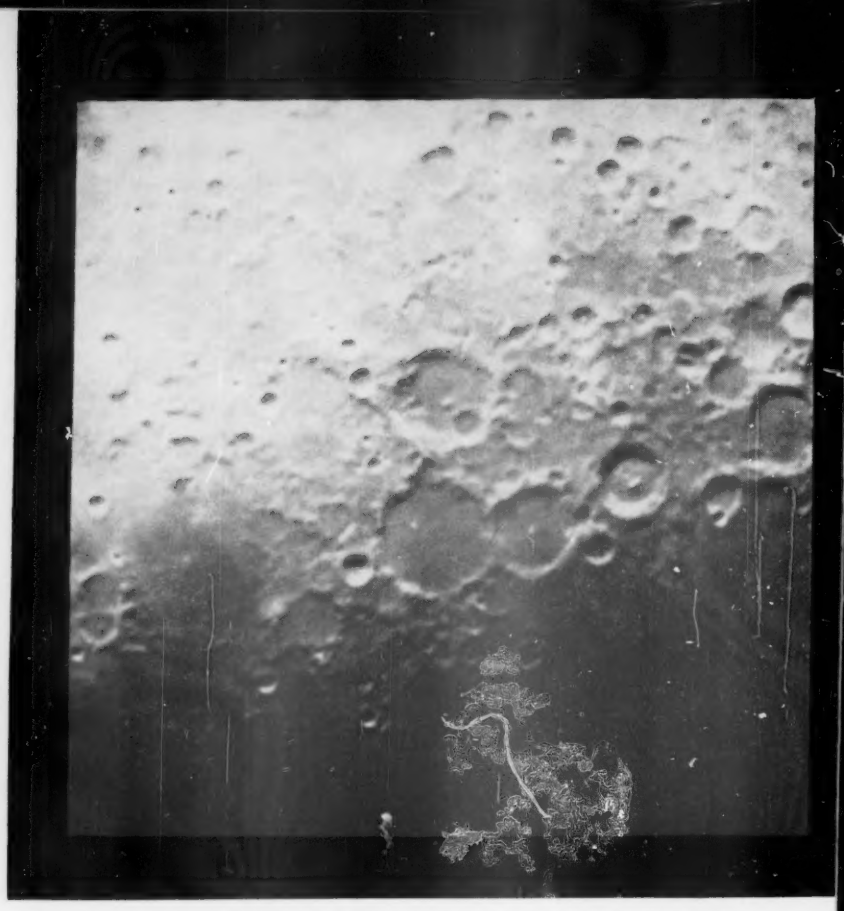
WHAT, then, can the stay-at-homes here on the Planet Earth expect to get for all these billions of dollars, and all the creative engineering that is being poured into outer space? The answer: probably as much or more as from any other scientific and technological endeavor in history.

The supporting evidence for this assertion is already visible in several hundred research centers and industrial laboratories. Chemicals, fuels, metals, electronics, computers, instrumentation, plastics, radio and TV communications, land surveying and mapping, weather forecasting, solar energy—these are only the major areas where space connected research and development will make highly significant contributions.

The chemical industry got a $230 million slice of the missile pie in 1958. The industry expects to get almost $500 million from missiles in 1959. Dramatic advances have been made in high powered fuels, and these advances will carry over from lifting rockets to many industrial processes. The Zip fuels based on combinations of boron, hydrogen, and carbon will be used to supplement present jet airliner fuels.

Metallurgical engineers, like their colleagues in chemistry, have set forth on a sizeable number of research quests to meet space age requirements. Special sheet steels get lighter and light metal alloys get tougher for missile configurations. Exposure to intense solar and cosmic radiation, meteoric dust, and temperatures near absolute zero in outer space means metallurgical searching for metals with unique characteristics.

The world's first casting of molybdenum has just been achieved at the U. S. Bureau of Mines laboratory at Albany, Oregon. Castings made from this silvery-white metal with a melting point of some 4,748 degrees Fahrenheit, may now be made for rocket parts, and will be available for other industrial uses.



One of the walled plains on the surface of our lunar neighbor will soon be an exploration base for man's first expedition to the moon. The scientific and technological efforts expended to get us there will result in a harvest of new products and processes back home on earth.

Under the stimulus of missile needs, yttrium, a metal long considered too brittle for structural uses, has been transformed into a pliable, easily formed material. Bureau of Mines metallurgists predict that the new yttrium, rid of dissolved gases, may find important applications in atomic reactor design.

In the realm of electronics, the impetus provided by missile and space activity has by now reached a stage which perhaps might best be described in terms of a calculus of infinite sets. The number of electronic gadgets for missiles and space probing to date is simply staggering. What engineers are doing with these gadgets amounts to nothing less than an extension of man's own cerebral mechanism out into space. And while the circuits become more sophisticated and complex, they are rapidly shrinking to the point of invisibility before our very eyes.

Vehicle guidance across hundreds of thousands and even millions of miles is a prime space age requirement. Angular trajectory error must be constantly corrected. The necessary inertial navigation devices, together with the computer units and miniturized electronic circuits, are coming into being. The decisions made by these devices are far more complex than those called for in highway driving. Sooner or later the auto industry will utilize these electronic combinations and cars will be able to speed safely along our expressways without a hand touched to steering wheel or foot to brake pedal.

In communications engineering, the space satellites have set the

stage for a plethora of new techniques. Messages radioed to satellites can be carried around to the opposite side of the earth in less than an hour, and relayed to a ground station without any trans-oceanic radio interference. A relay network utilizing satellites could carry radio and TV broadcasts, and a large number of telephone messages at the same time. International TV broadcasting based on satellite relays is a sure bet within the next few years, bringing programs from London, Paris, Moscow, and other points into competition for audience ratings.

International Telephone and Telegraph has announced the formation of a project called the END—Earth Net Dial—system. It calls for installing long-life receivers and transmitters in three equidistant satellites having a 24-hour orbit around the earth. This would put each satellite in a fixed position above the earth's surface. The satellites would relay TV programs from one side of the globe to the other and, the planners at ITT hope, will make it possible to dial Zanzibar directly from a phone booth in Kansas City.

The age-old subject of weather and what to do about it should receive one of the biggest shoves forward from space age engineering. In the earth satellites, man has for the first time a means by which to scan cloud formations over the entire planet. Meteorologists have long been aware that weather forecasts are extremely limited without data on a planet-wide basis. The satellites provide the key to recording the behavior of the planetary atmospheric currents, tracking cyclonic formations, measuring cosmic and solar radiation above the atmosphere, keeping tab on sun spot activity and the earth's magnetic fields, and performing a multitude of other data gathering chores that can be undertaken only in a fragmentary manner from the surface of our globe. The cause and effect relationships of weather and climate phenomena will be pinned down and data on these phenomena will be programmed and fed into computing centers. The output should be translatable into projections which will take weather predicting out of the guess and hunch doldrums in which it has languished while the other physical sciences have steadily improved in predictive accuracy.

Of course, spying on the world's weather from pole to pole and across mountain range, desert and ocean, will be possible only through a system of highly instrumented data reduction centers. These latter will be the engineering profession's contribution toward eliminating that old standby of summertime humor, the meteorologists' picnic which is rained out right in the middle of the annual softball game.

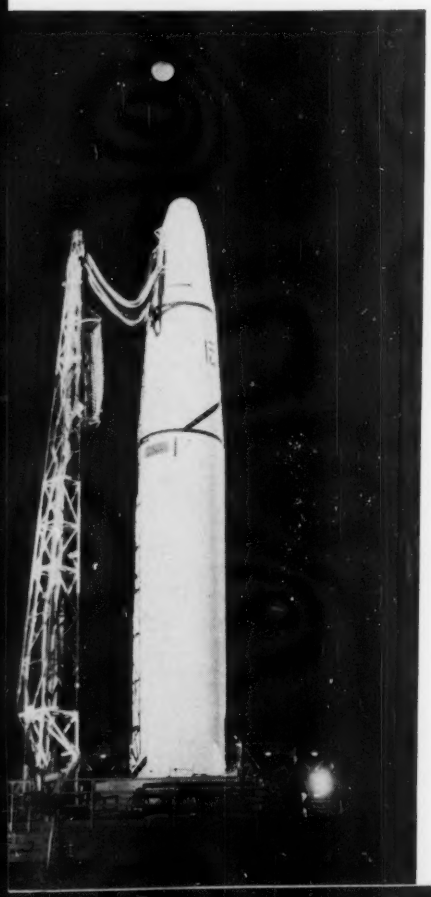
The practical uses of satellites are increasing in number and scope. Large-scale triangulation over land and sea areas is now getting on a workable basis as the geodesists are obtaining precisely determined satellite orbits. Such triangulations may result in a determination of the width of the Atlantic Ocean from any two land points to an accuracy of 100 feet. The consequences of this are obvious for precision mapping and surveying. Geophysicists are quite interested in using the satellites for a more exact knowledge of the earth's gravitational constant. Certain anomalies in this constant may be due to deposits of oil underneath a salt dome.

Up to the present, it appears that nuclear energy sources are being bypassed in all the major missile propellant programs. The principle of rocket thrust, with its relationship to the mass of the gases ejected from the rocket engine, tends to put conventional nuclear reactors in the role of energy sources without an effective application to space vehicle propulsion.

NEVERTHELESS, with E equal to MC^2, the power-packed atom cannot be counted out as a rocket propellant. In Project Rover, nuclear reactors as rocket energy sources are currently being studied. Most of the planning to date involves developing a hot exhaust gas by passing a working fluid through a fission reactor.

Other engineering approaches to the reactor-in-space problem have appeared in the open technical literature. The main obstacle here is not so much the engineering difficulties as it is a lack of enthusiasm on the part of some atomic energy policy advisors concerning a bold research and development program

Millions of engineering man hours are behind every multi-stage rocket vehicle.

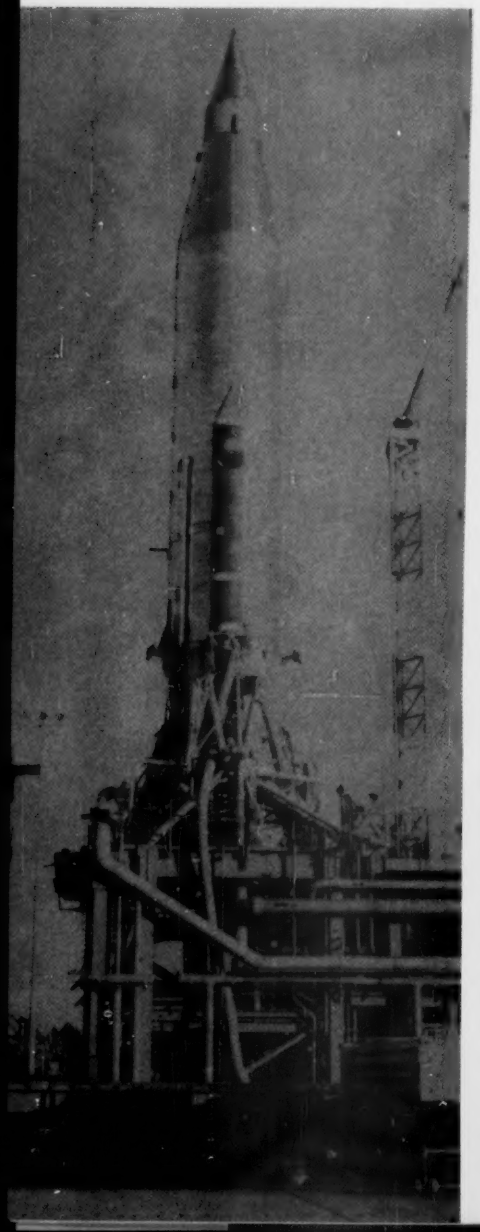


The most immediate effect from engineering for the space age will be in the creation and refinement of the tools and instruments of science.

in nuclear propellants for space projects. Surely the nation whose scientists and engineers first brought the world across the threshold of nuclear fission and fusion should be able to underwrite a working program which would investigate every aspect of utilizing the tremendous energy locked in the nucleus of the atom as a power source for moving out into the solar system. Statements by Soviet scientists suggest that Russian engineering and research teams are actively engaged in just such an investigation. If and when nuclear reactors are made "space worthy," the effect on power and research reactors will be considerable: both in civilian and military directions. Quoting from the House Space Committee report: "The military potentialities of space technology, which the United States would prefer to see channeled to peaceful purposes, are greater than general public discussion to date suggests. It would be highly impractical not to face the reality that space technology, like nuclear energy, can be used for war as well as for peace."

The question of the military implications of the space age is one which continues to be a topic of high-level political debate. The intercontinental ballistics missile has become an accepted part of the military picture, and space projects are increasingly viewed as also fraught with deep military significance. The House Space Committee report has this to say on the

The Air Force Atlas missile haa the engineering efforts of 1,209 companies behind it as primary suppliers.



The immensity of the universe around us—and of the engineering challenge involved in expanding man's horizons out into the solar system and beyond—is suggested in this star cloud in one small section of our Milky Way galaxy.

Guided missiles have become an integral part of the military arsenal.

subject: "Military space capabilities are technically inseparable from peaceful capabilities which are well worth pursuing in their own right. Reconnaissance for merchant ship lane patrol and for peaceful mapping of resources can also be used to locate military targets. Communications to improve global relations can also be used to control military forces. Rockets for cargo and passenger delivery can also carry thermonuclear weapons. Satellites designed to return men from an orbit to a preselected point can also deliver bombs. We are in an age of rapid technological change wherein the strategic balance of power can shift to the nation first achieving operational usability of new scientific developments. Neglect of new developments may create a time of weakness for a nation long enough for a strong rival to overwhelm and destroy it." This is rather a good distance away from the viewpoint expressed by a former Secretary of Defense who made a public statement to the effect that "no one is going to drop anything down on you from a satellite, so don't lose any sleep over it."

In the still futuristic speculation concerning such things as lunar and planetary bases, exploring the craters on the moons of Jupiter, and orbiting around the rings of Saturn, the military implications of space projects become even more impressive. The engineering achievements that will bring man to the deserts of Mars and into the clouds of Venus will mean great technological, and hence, military, strength.

The new products and processes which will flow from the engineering effort put into establishing exploration bases and scientific laboratories on our neighboring planets can only be guessed at in the year 1959. These quantum jumps in technological progress will undoubtedly include revolutionary changes in the chemical fuel situation, for land vehicles as well as aircraft; electronic circuitry affording ultra high fidelity sound reproduction in pocket-sized units, along with the capability to pick up radio broadcasts from the planets; solar energy power plants in the tropical regions and solar energy home heating units in the higher latitudes; wafer-thin TV screens providing crystal-clear and multi-dimensional pictures from an assortment of world channels; and climate control based on weather science able to study the earth from "outside and inside."

It does not take much in the way of imagination to greatly extend such a listing of future marvels. The space era is in reality an integral part of a broad expansion of scientific and technological activity. New products and processes through engineering will come in abundance whether or not man tries to lift himself off into space. The most immediate effect from engineering for the space age will be in the exploding development of the tools and instruments of science. The new instruments, almost all of which are based on engineering solutions of problems in circuits, packaging, telemetering, data recording, computing, miniaturization, and the like, have gathered enough information during the recently completed International Geophysical Year to keep theoretical scientists busy for the next several years. Examples of these new tools and instruments are to be found throughout the scientific community. The radio telescope at Manchester, England, is typical of these, and it is tracking satellites as well as tuning in on radiation billions of light years away. This instrument, the largest radio telescope in the world, is the result of collaboration in structural, mechanical, and electronics engineering.

The following instrumented experiments appropriate to satellites of various payload classes and lunar vehicles have been outlined in the RAND report:

1. Less than 100 pounds:

Cosmic-ray counters; mass spectrometer; measurements of total magnetic field, solar ultraviolet radiation, X-rays and gamma rays.

Observations of heat balance and albedo of earth.

Low-resolution pictures of earth, moon, and planets.

Density, composition, and temperature in upper atmosphere and solar corona.

Geodetic information from radio and visual observations of satellite orbits.

Micrometeorite densities.

Ionospheric density from radio signals.

Growth of spores or yeast in space.

Small mammals in a space environment.

2. One hundred pounds:

Small recoverable payload.

Highest resolution photographs of earth, moon, and planets; emulsion plates for detecting cosmic rays.

Measurement of vector components of geomagnetic field and its time variations.

Spectrum of the atmosphere of the earth and sun; hemispheric cloud observations.

Location of radiating points in space; cosmic radio noise at the low radio frequencies.

Tests of space environment on mammals.

Plant-growth cycle under weightlessness.

3. One thousand pounds:

Telescope to obtain spectra of planets, stars, and galaxies from far ultraviolet through infrared.

Combination meteorological satellite involving both television and infrared sensors.

Test of the general theory of relativity using atomic or molecular clocks.

Small animals in space in a closed ecological system.

Experiments to note animal body rhythms and activity in space.

4. Ten thousand pounds:

Larger animals and man in space.

Large telescopes for astronomical observation.

Lunar vehicles

Some of the purposes to which lunar rocket experiments might be turned include measurements of—

The mass of the moon. The current estimates of this quantity may be in error by as much as 0.3 per cent, and substantial inconsistencies exist between mass estimates based on asteroid observations and those implied by data on the motions of the Earth's polar axis.

The moon's magnetic field: At present we have virtually no knowledge whatsoever of the moon's magnetic field. Data on the magnetic field of the moon would allow us to make some progress in theories about the history of the moon, the processes of its formation, etc.

The composition and physical properties of the lunar atmosphere.

The composition and properties of the lunar crust.

Lunar surface temperature and its variation with time and depth.

Surface radioactivity and atmospheric electricity.

Seismic properties of the lunar interior.

THE same RAND report prepared by the RAND Corporation at the request of the House Space Committee, lists the following projects as technically possible now by adaptation of our present ICBM equipment:

Orbit satellite payloads of 10,000 pounds at 300 miles altitude.

Orbit satellite payloads of 2,500 pounds at 22,000 miles altitude.

Impact 3,000 pounds on the moon.

Land, intact, 1,000 pounds of instruments on the moon.

Land, intact, more than 1,000 pounds of instruments on Venus or Mars.

Probe the atmosphere of Jupiter with 1,000 pounds of instruments.

Place a man, or men, in a satellite orbit around the earth and recover after a few days of flight.

The "adaptations" necessary to achieve these space projects are engineering ones. The extent of engineering responsibility is pointed up in a further quotation from the RAND report: "In the most immediate and practical sense, astronautics is a very large engineering job. Equipments and facilities, often requiring substantial advances over current practice, must be designed and built. Severe environmental conditions and demands for high reliability over very long periods of essentially unattended operation will require uncompromising thoroughness and extensive testing. Bold imagination and painstaking attention to detail must be the twin hallmarks of engineering for space flight."

In any assessment of "what's to come," it must be emphasized that we can see ahead only a minute fraction of the way. The House Space Committee report describes the prediction situation in these words: "The greatest benefits of space development and exploration in all probability cannot even be predicted today. This has been true of countless past discoveries. The search which discovered America was intended to find a direct route to the Orient; the prize which was found was much more important. More recently, the by-products of nuclear reactors seemed at first an unwanted nuisance. But already the economic benefits of radioactive isotopes bring a return great enough to pay the capital charges on our entire peaceful and military investment in the atomic field. What may come in resources, in understanding of the forces of nature, in solving many of the present mysteries of life may be beyond all immediate human understanding. This is not the kind of challenge man can safely ignore."—**End.**

A U.S. Steel metallurgical engineer shows test samples of a new alloy sheet steel which is air hardenable and after tempering develops tensile strength levels in the 280,000 pounds per square inch area without quenching in oil. A two-year research project for the steel was undertaken to meet missile requirements.

FROM WASHINGTON

BY
MILTON F. LUNCH,
N.S.P.E.'s Legislative Counsel

ENGINEERING AND SCIENCE ISSUES CLOSE OUT THE YEAR IN A BLAZE OF ACTIVITY

THE week between Christmas and New Year's is the traditional time for the annual meeting of the American Association for the Advancement of Science. In 1958 it was in Washington, just preceding the opening of the 86th Congress on January 7, 1959. Whether the location and timing was coincidence, the AAAS week-long affair, referred to as a "smorgasbord of science," generated an atmosphere emphasizing the impact of technology on national and international affairs with which the new Congress must cope.

◄ Dr. James R. Killian, Jr.

Among the significant events at the AAAS meeting was the address by Dr. James R. Killian, Jr., special assistant to the President for Science and Technology, on "Science and Public Policy." The major portion of the address was a comprehensive review of the many activities and programs of scientific and engineering import to national affairs, and particularly the work of the President's Science Advisory Committee. Dr. Killian commented that the President, in creating the Science Advisory Committee, had "given special recognition to the fact that science and technology, apart from their use in solving specific problems, have a direct and creative impact on the formulation of public policy." At the same time, Dr. Killian cautioned engineers and scientists not to view the growing linkage of science and technology with Government as a basis for underestimating the other disciplines and elements in evaluating the total national picture. The current emphasis on science, he said, "if it is not to cause reactions adverse to science, also requires of the scientific community humility and a sense of proportion."

The Killian observation can be read in the context of the continuing discussion over the organization of engineering and science activities in the Federal Government—should there be a Department of Science? In his remarks, Dr. Killian offered the following quotation from Don K. Price, a well-known analyst of the scientific organization question:

"In the organization of the Government for the support of science we do not need to put all of science into a single agency; on the contrary, we need to see that it is infused into the program of every department and every bureau. We do not need to insulate it from executive authority; on the contrary we shall protect it best from political interference and enable it to be most effective if we give it a direct and affective relationship with the responsible executives, as well as the support of well organized groups of advisers from the leading private institutions of the nation."

Dr. Herbert York ►

Almost coincident with the Killian speech, President Eisenhower announced the establishment of a new body to accelerate scientific and technological progress, to be known as the Federal Council for Science and Technology. The new group was recommended by the Science Advisory Committee and will also be headed by Dr. Killian. It will be an interagency body to promote coordinated policy planning and more effective management of Federal programs in science and technology, consisting of representatives of the major Federal agencies in the science field, plus other departments and agencies with smaller research and development budgets when matters of concern to them are considered, and a representative of the Bureau of the Budget and the Science Adviser to the Secretary of State, as observers.

The White House announcement of the new Council was accompanied by a 20-page report of the President's Science Advisory Committee, "Strengthening American Science," which reviews the tremendous impact of technology on governmental affairs and suggests a number of areas for increased activity and improved coordination. The report specifically rejects

the idea of a Cabinet-level department of science, and many observers see the emergence of the new coordinating Council as a means to head off Congressional demands for a separate department. If so, Representative John W. McCormack of Massachusetts, Democratic leader of the House and chairman of the House Committee on Astronautics and Space Exploration, was not convinced. He announced upon the convening of Congress that he would press for a Cabinet-level Department of Science "to achieve the proper coordination of Government activity in this area." Representative McCormack was expressing a note of urgency felt by many of the legislators as a result of the dramatic Russian achievement in launching its "Lunik." Whether this feeling or urgency will spill over into a Congressional revolt against the plans of the Administration will be known as Congress gets down

◄ Rep. John W. McCormack

to business. At the moment, the preliminary Congressional attitude appears to be one of some dissatisfaction with the rate of planned programming for the space program, coupled with the realization, however, that it is difficult, if not impossible, for Congress to take over and force a large expansion in a field within the administration and control of the Executive Department.

The President had relatively little to say about science and engineering in his State of the Union message, contrasted with the message last year which listed eight points in the science area which were "imperative." The lesser attention in the current message, however, may be attributed to the state of flux arising from the whole series of actions in the last Congress, which are only now reaching the stage of implementation—the new space agency, the National Defense Education Act, the reorganization of the scientific and engineering activities of the Department of Defense, and others. Dr. Herbert York has been named to the new office of Director of Research and Engineering in the Department of Defense and will be much involved in coordinating the activities of the Advanced Research Projects Agency with the civilian space agency.

To round out this series of year-end developments, there was the final report to the President by The President's Committee on Scientists and Engineers. The group, headed by Dr. Howard L. Bevis, was established in April, 1956, to aid in identifying the problems associated with the development of more highly qualified scientists and engineers, to secure cooperation of all interested groups toward this end and to coordinate related programs, to provide information and to publicize the problem and possible solutions. The final report embraces a number of activities which were formulated or stimulated during the brief life of the organization: Local Action to improve science and mathematics teaching in the public schools, improvement of guidance and counseling programs, use of highly qualified technicians, and others. Perhaps the most significant activity, however, at least from NSPE's point of view, was the inauguration of a series of conferences at the grassroots level to improve utilization of engineering and scientific personnel. The report officially notes the dual sponsorship of the appropriate schools of engineering and the state societies of NSPE. Although the Bevis Committee, as it came to be called, is now defunct, the pattern of utilization conferences, with continued NSPE backing, will be carried on and extended during 1959 under the sponsorship of the Office of Civil and Defense Mobilization.

Based on its highly concentrated and extensive

Dr. Howard L. Bevis ►

study, the Bevis Committee made some significant recommendations in its "swan song." It was suggested that the Federal Government, at the White House level, should assume responsibility for coordinating and stimulating the Nation's effort in the development and utilization of highly trained manpower. The President was urged to continue the programs already started and there was some intimation that there are now too many Federal groups in the manpower field. Although it was noted that there had been a massive array of committees to study the skilled manpower problems, there should be another group from the Federal agencies to examine the problem and recommend to the President a suitable White House organization for highly trained manpower, the Bevis group said.

A rather common thread running through all of this year-end activity was the somewhat nebulous and debatable "shortage" of engineers and scientists. The Bevis Committee, for example, noted with some alarm a drop of thirteen per cent in freshman engineering enrollments this past fall (later amended by the Office of Education to a drop of eleven per cent in freshman enrollment and a 2.4 per cent drop in over-all undergraduate and graduate engineering enrollment). The "shortage" claims and counterclaims came in for some very extensive and detailed analysis at the AAAS session on scientific manpower, from which emerged a new phrase to express what many would think is a more accurate conclusion—"a sense of shortage." In other words, 1959 would appear to be a year in which the manpower atmosphere will be uncertain and confused, but over that confusion and uncertainty will hang a somewhat vague but persistent "feeling" that the nation is very close to the "shortage" line, if not over it.

A LISTING OF THE STATE BOARDS

For the convenience of our readers, we are listing below the names and addresses of the various State Registration Boards. It is suggested that this issue of the American Engineer be filed for future use.

Alabama State Board of Registration for Professional Engineers and Land Surveyors
Clifton C. Cobb, Executive Secretary
711 High Street, Montgomery 5, Alabama

Alaska Territorial Board of Engineers and Architects Examiners
R. V. Killewich, Secretary
Box 1416, Juneau, Alaska

Arizona State Board of Technical Registration
Mrs. Rayma Neeb, Executive Secretary,
Room 403, 128 N. 1st Avenue
Phoenix, Arizona

Arkansas State Board of Registration for Professional Engineers
B. Allan Curry, Secretary-Treasurer
P. O. Box 1117, Park Hill Station
North Little Rock, Arkansas

California State Board of Registration for Civil and Professional Engineers
Arthur I. Flaherty, Executive Secretary
529 Business and Professions Building
1020 N Street,
Sacramento 14, California

Canal Zone Board of Registration for Architects and Professional Engineers
Gerald A. Doyle, Jr., Secretary
P. O. Box 223, Balboa Heights,
Canal Zone

Colorado State Board of Registration for Professional Engineers and Land Surveyors
James S. Findley, Asst. Secretary
Room 220, Majestic Bldg.
Denver 2, Colorado

Connecticut State Board of Registration for Professional Engineers and Land Surveyors
Charles H. Coogan, Jr., Secretary
30 Oak Street
Hartford 6, Connecticut

Delaware State Board of Registration for Professional Engineers and Land Surveyors
Frank T. Lynch, Secretary-Treasurer
11 East 12th Street
Wilmington, Delaware

District of Columbia Board of Registration for Professional Engineers
Mrs. Lacey W. Coad, Executive Secretary
1740 Massachusetts Ave., N. W.
Washington 6, D. C.

Florida State Board of Engineer Examiners
Mrs. Ann P. Clover, Executive Secretary
408 John F. Seagel Building,
Gainesville, Florida

Georgia State Board of Registration for Professional Engineers and Land Surveyors
Cecil L. Clifton, Joint Secretary
224 State Capitol, Atlanta, Georgia

Hawaii Board of Registration for Professional Engineers, Architects and Land Surveyors
William C. Furer, Executive Secretary
1909 Aleo Place (Manoa),
Honolulu 14, Hawaii

Idaho State Board of Engineering Examiners
S. M. Barton, Assistant Secretary
500 Idaho Street
Boise, Idaho

Illinois Professional Engineers' Examining Committee
Fredric B. Selcke, Supt. of Registration
Room 109,
State Capitol, Springfield, Illinois

Indiana State Board of Registration for Professional Engineers and Land Surveyors
Ferdinand Jehle, Secretary
Room 502,
145 W. Washington St.,
Indianapolis, Indiana

Iowa State Board of Engineering Examiners
W. G. Cunningham, Secretary
State House, Des Moines 19, Iowa

Kansas State Board of Engineering Examiners
Mrs. Della Sterrett, Executive Secretary
1159 W. State Office Building
Topeka, Kansas

Kentucky State Board of Registration for Professional Engineers
C. S. Crouse, Secretary-Treasurer
223 Mineral Industries Building
120 Graham Ave.
Lexington, Kentucky

Louisiana State Board of Registration for Professional Engineers and Land Surveyors
F. W. Macdonald, Executive Secretary
Room 233, Civil Engineering Building
Tulane University
New Orleans 18, Louisiana

Maine State Board of Registration for Professional Engineers
Bryant L. Hopkins, Secretary
Box 103, Waterville, Maine

Maryland State Board of Registration for Professional Engineers and Land Surveyors
J. W. Gore, Secretary
1101 Key Highway,
Baltimore 30, Maryland

Massachusetts State Board of Registration of Professional Engineers and Land Surveyors
L. T. Schofield, Secretary
48 Park St., Framingham, Mass.

Michigan State Board of Registration for Architects, Professional Engineers and Land Surveyors
Henry G. Groehn, Executive Secretary
1604 Cadillac Square Building
Detroit 26, Michigan

Minnesota State Board of Registration for Architects, Engineers and Land Surveyors
Miss Helen D. Carlson, Executive Secretary
316 New York Building
St. Paul 1, Minnesota

Mississippi State Board of Registration for Professional Engineers
O. B. Curtis, Sr., Secretary
P. O. Box 3, Jackson, Mississippi

Missouri State Board of Registration for Architects and Professional Engineers
Mrs. Clemmie V. Wall, Secretary
Box 184, Jefferson City, Missouri

Montana State Board of Registration for Professional Engineers and Land Surveyors
Harvey W. Taylor, Executive Secretary
P. O. Drawer 291, Capitol Post Office
Helena, Montana

Nebraska State Board of Examiners for Professional Engineers and Architects
Roy M. Green, Secretary
512 Trust Bldg., 941 "O" Street
Lincoln 8, Nebraska

Nevada State Board of Registered Professional Engineers
Stanley G. Palmer, Secretary
University Station
P. O. Box 9052, Reno, Nevada

New Hampshire State Board of Registration for Professional Engineers
W. E. Haynes, Secretary
c/o Secretary of State, State House
Concord, New Hampshire

New Jersey State Board of Professional Engineers and Land Surveyors
Thomas E. Heathcote
Secretary-Director
1100 Raymond Blvd.,
Newark 2, New Jersey

New Mexico State Board of Registration for Professional Engineers and Land Surveyors
Mrs. Sybel Clagett, Asst. Secretary
P. O. Box 2074,
Santa Fe, New Mexico

New York State Board of Examiners of Professional Engineers and Land Surveyors
Newell L. Freeman, Secretary
c/o New York State Education Dept.
23 South Pearl Street,
Albany 7, New York

North Carolina State Board of Registration for Professional Engineers and Land Surveyors
Robert B. Rice, Secretary
P. O. Box 5131, N. C. State College
Raleigh, North Carolina

North Dakota State Board of Registration for Professional Engineers
A. L. Bavone, Secretary
P. O. Box 1265, Minot, North Dakota

Ohio State Board of Registration for Professional Engineers and Surveyors
Robert N. Waid, Secretary
21 West Broad Street
Columbus 15, Ohio

Oklahoma State Board of Registration for Professional Engineers
Gwynne B. Hill, Secretary
2901 Classen Blvd., 225 Cameron Building, Oklahoma City, Oklahoma

Oregon State Board of Engineering Examiners
E. A. Buckhorn, Secretary
717 Board of Trade Building
Portland 4, Oregon

Pennsylvania State Registration Board for Professional Engineers
Miss Louise J. Franklin, Secretary
570 Education Building
Harrisburg, Pennsylvania

Puerto Rico Board of Examiners of Engineers, Architects and Surveyors
Joaquin Mercado-Cruz, Secretary
P. O. Box 3271
San Juan, Puerto Rico

Rhode Island State Board of Registration for Professional Engineers and Land Surveyors
Philip S. Mancini, Secretary
246 State Office Building
Providence, Rhode Island

South Carolina State Board of Engineering Examiners
Miss Miriam E. Gibbons
Assistant Secretary
P. O. Drawer 1404
Columbia, South Carolina

South Dakota State Board of Engineering and Architectural Examiners
E. D. Dake, Secretary
S. D. School of Mines and Technology,
Rapid City, South Dakota

Tennessee State Board of Architectural and Engineering Examiners
William H. Rowan, Secretary-Treasurer
P. O. Box 1810, Station B
Nashville, Tennessee

Texas State Board of Registration for Professional Engineers
Thomas C. Green, Executive Secretary
308 W. 15th St., Room 403
Austin 14, Texas

Utah Representative Committee of Professional Engineers and Land Surveyors
Frank E. Lees, Director
318-A State Capitol Building,
Salt Lake City, Utah

Vermont State Board of Registration for Professional Engineers
Walter D. Emerson, Secretary
Norwich University
Northfield, Vermont

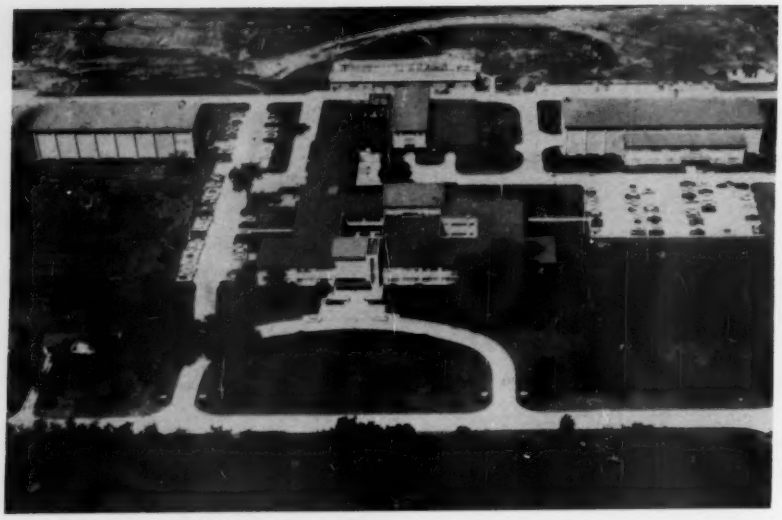
Virginia State Board for the Examination and Certification of Professional Engineers, Architects and Land Surveyors
Turner N. Burton, Secretary
P. O. Box 1-X, Richmond, Virginia

Washington State Board of Registration for Professional Engineers and Land Surveyors
Edw. C. Dohm, Secretary
Department of Licenses, Professional Division, General Administration Bldg.
Olympia, Washington

West Virginia State Registration Board for Professional Engineers
Robert Williamson, Jr., Secretary
301 Morrison Building
Charleston, West Virginia

Wisconsin State Registration Board of Architects and Professional Engineers
W. A. Piper, Secretary
1140 State Office Building
Madison 2, Wisconsin

Wyoming State Board of Examining Engineers
Mrs. Wilma H. Lang, Asst. Secretary
201 State Capitol Building
Cheyenne, Wyoming



Aerial view shows two new buildings erected in a $3 million expansion of the Portland Cement Association's research and development facilities in Skokie, Ill. In the center are the main and auxiliary laboratory buildings completed in 1950. At left is the new structural laboratory, and at right the new fire research center.

PCA Opens 'World's Largest Testing Lab'

THE "world's largest testing machine" is now ready for use at the Research and Development Laboratories of the Portland Cement Association, near Chicago.

The "machine" is actually a three-story high structural laboratory, constructed above ground entirely of precast concrete building units which were tilted or lifted into place by giant rigs and cranes. The massive floor of the building is designed like an exceptionally strong bridge, and is pierced by a total of 690 holes. By using relatively simple apparatus in combination with the floor, engineers and technicians at the new laboratory are able to conduct many tests that cannot be carried out anywhere else in the world.

The building, part of a $3-million expansion of the Association's research and development facilities at Skokie, Ill., is expected to produce information having a far-reaching effect on design and construction of many types of concrete structures. It adds 22,400 square feet to the 103,400 square feet of research facilities already at the site.

Floor Two Feet Thick

The structural laboratory is unique primarily because of its testing floor. The top surface of the floor is twenty-four inches thick, and is joined to an eighteen-inch thick basement floor by a series of 8½-foot high walls. In cross section, it resembles a large hollow box-girder bridge. Actually, the floor is built much stronger than an ordinary bridge because it acts as a test frame for all the forces applied to specimens in the laboratory.

The top surface of the floor is pierced by holes every three feet along its 120-foot length and fifty-six-foot width. To make most tests, steel rods are attached to the test beam or girder, and extended downward through the holes to connect with hydraulic jacks located in the basement. These jacks pull down on the rods, exerting enormous loads on the test structures above.

THE laboratory earns its title as "the world's largest testing machine" not only because of its size, but because of the tremendous test loads it can handle. The floor can withstand test pressures produced by the hydraulic jacks of more than ten million pounds. By comparison, one of the largest conventional testing machines, recently installed, can produce a load of five million pounds. In addition, the structural laboratory can apply its loads easily at any point, and in any direction, on specimens of practically any size or shape.

In the building, a floor slab or roof shell can be subjected to local loads of as high as 30,000 pounds per square foot. A slab the size of the entire testing floor could be subjected to a load of many thousands of pounds per square foot. A fifty-foot long beam can be given a total load of some two million pounds—forces considerably in excess of those that actual structures are required to withstand.

The new laboratory is already at work testing various types of structures and building units. A project is now underway to develop additional engineering information about newer types of concrete shell roofs. This type of roof, which can span great distances with a shell of concrete only a few inches thick, has become increasingly popular for large buildings such as stadiums, aircraft hangars and exhibition halls.

Another project is aimed at development of better methods of connecting precast concrete units, such as factory-produced beams, wall panels, columns and girders. Prestressed concrete, a very rapidly growing type of concrete construction, will also be studied, to extend its applications still further.

Building Interesting in Other Ways

Although the testing floor is the most unusual portion of the new laboratory, the rest of the building

shows off some advanced practices in the structural and architectural use of concrete.

The entire laboratory above the first floor was assembled from precast units, erected by power equipment. These units were designed by a new method of engineering analysis called "ultimate strength design," which is beginning to supersede the method currently used by most structural engineers. The "ultimate strength" method takes into account more exactly than older methods the inherent strengths of concrete and reinforcing steel, and makes possible the construction of longer spans and higher buildings out of reinforced concrete.

The walls of the building were cast in forms lined with rubber mats. After the concrete had hardened, the mats were stripped away, leaving wall surfaces with an attractive, textured surface.

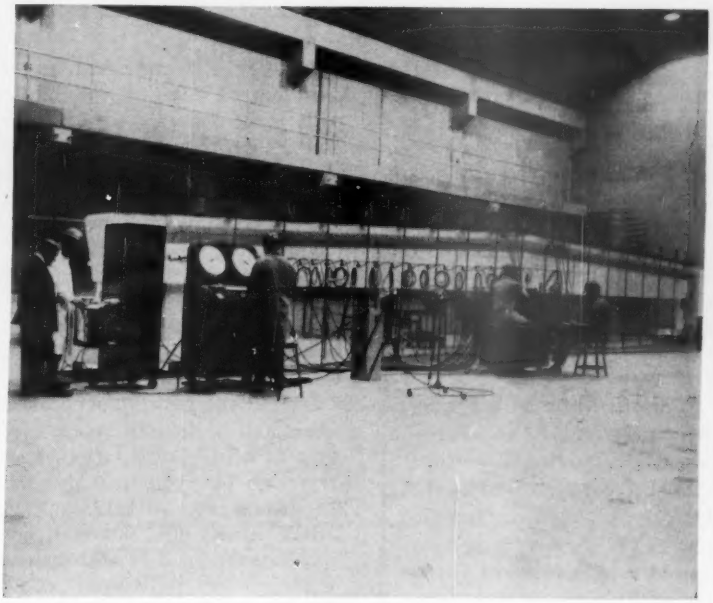
THE steel used for reinforcement was specially rolled from alloy steel having about twice the strength of ordinary reinforcing. The concrete is also much stronger than that used in most structures.

The entire building is air-conditioned to a constant temperature and humidity to prevent atmospheric changes that might affect test results. Three stories of offices and shops are located at one end of the building, and the basement is utilized for additional shops and storage. Test specimens are usually cast right in the laboratory.

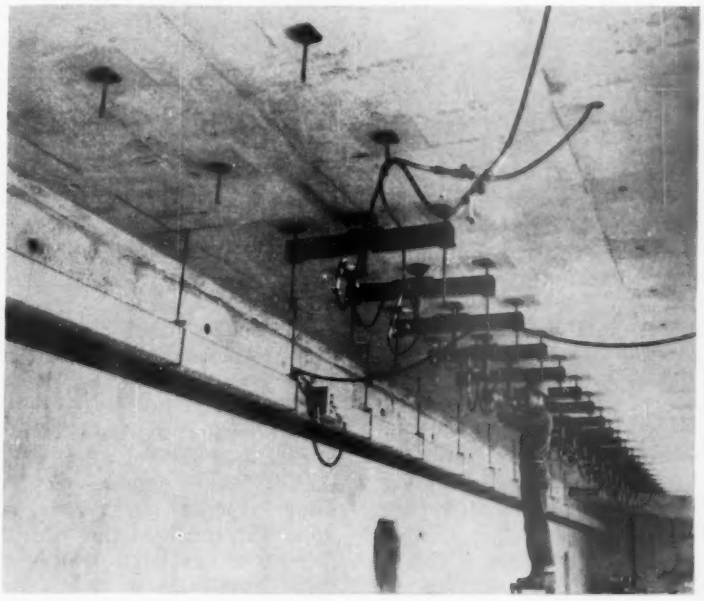
Second Laboratory Completed

The structural laboratory is under the direction of Dr. Eivind Hognestad, manager of the Association's Structural Development Section, and is under the over-all supervision of Douglas McHenry, director of development.

A second building recently erected at the laboratories, the Fire Research Center, has been completed but is not operational. It will be equipped this spring with several huge furnaces for testing the fire resistance of full-size concrete beams, slabs and structural members. It will be the only laboratory in the United States equipped for this specific type of work. Other fire testing laboratories, such as Underwriters Laboratories in Chicago, are devoted to establishing fire resistance ratings. The Portland Cement Association laboratory will be used primarily for research aimed at improving the fire resistance of concrete and concrete building elements.—**End.**



A 60-foot girder is shown above under test in the Portland Cement Association's new structural laboratory. Test forces are applied through steel rods, which can be seen extending from cross pieces over the girder down through holes in the floor. Under the floor are hydraulic jacks which pull down on the rods. This beam was later broken under a total load of 360,000 pounds. Underside of the first floor slab during test of the 60-foot girder is pictured below. Such compact hydraulic jacks can exert forces of up to 100,000 pounds through each of 690 holes in the floor. Each jack is carefully calibrated, and hydraulic pressure is accurately measured to determine test loads.



Organizing the Profession . . .

A Report from AIEE

THE Board of Directors of the American Institute of Electrical Engineers, meeting in San Francisco, June 28-29, 1956, adopted a proposal regarding organization of the engineering profession of the United States which has since come to be known as the Functional Plan. Having spent some time sitting as a "Committee of the Whole" to discuss all aspects of the matter in detail, the Board reconvened to take the following actions:

Editor's Note: **This is a report prepared by the Inter-Society Relations Committee of AIEE and approved by the Institute's Executive Committee. This report was presented to the Board of Directors of Engineers Joint Council in response to a request to the constituent societies to prepare statements evaluating the work of EJC and suggesting areas for its future development.**

(1) VOTED to adopt in principle, and actively to support, three organizations of a character approximating the present Engineers Joint Council (EJC), the Engineers Council for Professional Development (ECPD), and the National Society of Professional Engineers (NSPE), with certain functional modifications (as recommended by the Committee of the Whole) as currently most suitable to serve the over-all needs of the engineering profession.

(2) VOTED to request the president to appoint a special committee to draft, subject to Board approval, a statement to the members and other interested parties, setting forth the proposed AIEE position on intersociety relations as recommended by the Committee of the Whole.

(3) VOTED to request the president to appoint a committee with instructions to approach NSPE with the suggestion that its membership be opened, for a period of years, to nonregistered engineers holding suitable grades in technical societies subscribing to ECPD uniform membership grade standards.

(4) VOTED to rescind the instructions to AIEE representatives on the EJC Board of Directors to work for the development of EJC into an individual membership type of unity organization.

Action (4) related to long-standing instructions to AIEE representatives on the EJC Board of Directors to work for the development of EJC into an individual membership type of unity organization. Under the Functional Plan there would be no point in making EJC over in this way.

The functional modifications referred to in action (1) provided that EJC would relinquish its activities in the fields of employment conditions, labor legislation, practice of engineers, social security legislation, and certain kinds of surveys (the more recently initiated activity in engineering education would likewise be considered inappropriate); that ECPD would relinquish its interest in the practice of engineering; and that NSPE would relinquish its activities in the fields of technical education and young engineers.

The accompanying chart shows the Functional Plan.

THE Engineers Joint Council would function primarily as a coordinating body for technical matters crossing the boundaries of the various disciplines. It would retain its interest in the recognition of specialties, honors for engineers, national engineers register, and relations with corresponding bodies in foreign countries. It would continue functioning in such fields as national water policy and national transportation policy. It would function in an advisory capacity to the Federal Government in the engineering field in a manner similar to the functioning of the National Academy of Science in the scientific field. It should concern itself with the restoration abroad of respect for American engineering accomplishments, which we understand has recently suffered a decline. It would keep alert to the need for service to the engineering profession in newly developing fields of broad scope, such as nucleonics, and would take the initiative in arranging for such coverage by appropriate groups of its constituent societies, so as to prevent the formation of splinter groups. This is the "technical" group of activities.

The Engineers Council for Professional Development would continue its interest in the education and development of young engineers, the establishment of standards for engineering education, the accreditation of engineering curricula, and the canons of ethics. This is the "educational" group of activities.

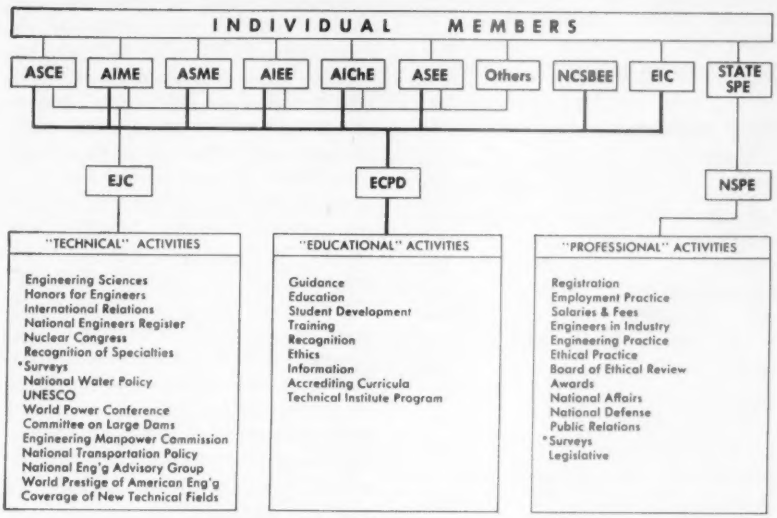
The National Society of Professional Engineers would continue its activities relating to registration of engineers and economic considerations in the employment of engineers, including salaries and fees. It would be responsible for promulgating rules of behavior in conformity with the ECPD canons of ethics and for legal enforcement of discipline under these rules. These rules would be formulated with the cooperation of ECPD. NSPE would be the spokesman for the profession in matters of legislation of interest to engineers at the national level, and its constituent state societies and local chapters would perform a similar function at the state and local levels. It would be responsible for public relations to enhance the social and economic standing of the engineering profession as a whole. The other societies would of course be

free to conduct such public relations activities as they consider appropriate in their own specific fields. The activities allocated to NSPE are those in the "professional" group.

With regard to surveys of the profession, these would be the function of EJC when related to technical matters. When the subject to be surveyed is political or has to do with economic welfare and working conditions of engineers, it would be a responsibility of NSPE.

It is not contemplated under the Functional Plan that AIEE would discontinue any of its interests or activities or any of the services which it customarily has been giving to its members, including students. Because of the variation in conditions affecting engineers in the various disciplines, it is contemplated that the Founder Societies and other similar groups will continue to maintain committees on such matters as education, registration, professional conduct, etc., for liaison with ECPD or NSPE, as the case may be, to insure that those groups are kept informed as to the particular viewpoints of the various disciplines.

FUNCTIONAL PLAN FOR THE ENGINEERING PROFESSION



* *EJC—When the subject is Technical.*
NSPE—When the subject is Political, or Economic Welfare, or Working Conditions of Engineers, etc.

Note:—UET, Conference Board for Industry, AAAS continue to function as at present.

Registration and NSPE

It is contemplated under this plan that the great majority of engineers would be affiliated with NSPE as well as with one or more of the societies which are constituents of EJC and ECPD. It will be noted that action (3) provided for a *suggestion* to be made to NSPE, without imposing this as a condition related to action (1). During subsequent meetings of the AIEE Board it was decided that if NSPE would adopt this suggestion, AIEE would urge all of its members to affiliate with NSPE, whether registered or not.

AIEE has for many years recommended to its members that they take steps to register as professional engineers. We believe that this is an essential step in the full development of the engineer, whether he be a consultant or employed in government or industry. We urge all young engineers to register in their states as early in their careers as possible. If this advice is heeded by members of all the Founder Societies, it is obvious that the time will come when the same people who make up those societies will be the members of NSPE, or at least eligible for membership in NSPE. It is believed that NSPE can put itself immediately in a much stronger position to carry out the responsibilities proposed for it by the Functional Plan if, for a period of years, it will open its membership to nonregistered engineers who are otherwise qualified as evidenced by their holding suitable grades of membership in those societies which subscribe to ECPD uniform membership grade standards. This is the reason for making this *suggestion* to NSPE as an interim measure and offering, if it is accepted, to urge all of our members both registered and nonregistered, to join NSPE. NSPE already recommends that all of its members join their appropriate technical societies.

NSPE has not *as yet* adopted our suggestion as regards membership at the national level. However, after analysis of the results of a questionnaire distributed to all of its state societies and local chapters, it took formal note of a considerable expression of opinion of its members in favor of considering the extension of membership in NSPE in any reasonable way to assist in the implementation of the Functional Plan, which it approved in principle. NSPE therefore decided not to change membership requirements at the national level "at this time" (June, 1958) but recommended that the several state societies take such steps as may be necessary to admit properly qualified persons to membership. It should be noted that many of these state societies now admit nonregistered engineers, in some proportion, to membership.

Late in September, 1958, AIEE sent out a questionnaire to its 13,905 Fellows and members in the United States to find out how many were registered, how many of those were members of NSPE, and how many of the nonregistered would join NSPE if the suggestion discussed was accepted. Seventy-one per cent of the questionnaires were returned, but a surprisingly large number had to be discarded either for failure to answer completely or because of inconsistencies between the replies and the instructions. A total of some 7,400 replies were valid (fifty-three per cent of total mailed out). Of these, sixty-three per cent stated that they were registered. Of those registered, forty-six per cent stated that they are members of NSPE. Of the nonregistered group, seventy-

one per cent indicated that they would join NSPE if given the chance. AIEE is still hopeful that NSPE will provide the opportunity for these men to join.

Unity Organization

AIEE is not opposed to the establishment of one unity organization for engineers. In the discussion of the Committee of the Whole which led up to the adoption of the Functional Plan, it was recorded that we should take no position *for* or *against* the establishment of such a unity organization at this time.

The establishment of a unity organization would not be inconsistent with the Functional Plan. It could take either of two forms. It could be a coordinating council made up of representatives of EJC, ECPD, and NSPE. Since the fields of activity of the respective organizations would be clearly defined and limited by the Functional Plan, such a coordinating council would probably serve principally to insure against overlapping or duplication of interests and as a symbol of complete unification of the profession. It should require little or no staff and its budget could be very small.

Alternatively, the unity organization could be an individual membership society with dues paid by all members of all the underlying societies and with officers elected by the direct vote of all those members. Such a unity organization would be stronger than a top coordinating council because of its large individual membership. With its officers and governing body elected by all the members directly, it would be in a position to speak with authority and would have the power to take action promptly on its own responsibility.

In declining to express itself for or against the establishment of an over-all unity organization in connection with the proposal of the Functional Plan, AIEE felt that a step of this kind should be deferred for a few years until experience has been gained with the operation of the Functional Plan as a guide to the proper type of unity organization if one should then appear to be desirable.

Merger of ECPD and EJC

There has been considerable discussion recently of a proposal to consolidate ECPD with EJC and to set this up as the top unity organization with three "divisions" active in the technical, educational, and professional fields. It is proposed that NSPE become one of the constituent societies. Under this plan the present ECPD organization would presumably continue to function as the "educational division" of the proposed council type of unity organization. The proposal makes no statement that NSPE would become the "professional division" of the organization. Some proponents of the plan have indicated that NSPE would probably be given responsibilities in this area gradually "as they demonstrated their ability to handle them." It is certain that NSPE cannot accept this. Recognition must be given to the fact that NSPE is one of the largest engineering societies, that it has been in existence for many years, that it is growing, and that it has been doing excellent work in the field assigned to it by the Functional Plan.

The proposal for the consolidation of ECPD and EJC with three divisions is silent as to the form of organization of the "professional division." Inasmuch as legislation affecting engineers, to take one example, may be at the national, state, or local level, it should be obvious that to do an effective job in this area would require committees and staff in every state as well as committees in every county throughout the country. This would be a tremendous undertaking for the proposed joint council, would take many years to accomplish and involve tremendous expense. NSPE through its constituent state societies and local chapters already has this organization and it is doing business. For the proposed joint council to undertake to duplicate this would not appear to be good "engineering." In fact, for the professional division of the proposed joint council to engage in all of the activities proposed for NSPE under the Functional Plan would undoubtedly result in doubling the members' dues.

AND what would be gained? It is the state society of professional engineers that is already recognized as the spokesman for engineers in the state. In New York, for example, members of the state legislature say that the engineers they can readily recognize, in the public view, are those who are registered and the only society they can look to is the state society of professional engineers. Legislation affecting engineers is referred to that society and its disposition is practically decided by the attitude of the society. The governor also frequently takes counsel with the society's officers. This is the picture in other states as well. Does the suggested new joint council expect to be able to set up organizations in all the states and have these accepted by the state governments as the voice of the profession in place of the existing state societies? Or does it expect to have its voice heard in addition to, and perhaps sometimes in opposition to, the state societies? Or does it propose merely to claim the authority to represent the profession in this field and let NSPE continue to do the actual work?

As a matter of fact, AIEE is unable to see how this organization could be established with a "professional division" without duplicating the committees that already exist within NSPE. Thus, an impossible situation would be created for NSPE in which its functions would be taken over by the new organization. This would foster serious conflict and disunity. The new organization would be at a disadvantage because its financial income would be small compared to the dues income of NSPE. Also, its strength, influence, and activities in local communities would be comparatively small.

Moreover, ECPD stands now as a body reflecting credit and unity on the engineering profession, lending distinction and responsibility to its officers and chairman, with its accreditation a cornerstone in the administration of many state registration regulations. There appears, to AIEE, to be little to be gained and much to be lost by merging it into an organization in which the seeds of incompatibility are inherent so

(Continued on page 46)

New Literature

TOOLING—A 28-page brochure called "Short Run Tooling for Long Range Economy" is announced by Arrowsmith Plastic Tooling, Inc. The brochure is thoroughly illustrated and, according to the manufacturer, is intended to show how short-run or "soft" tooling may be used to reduce tooling time and expense in the forming of diverse products.

(Circle 15 in Readers' Service Dept.)

BOILERS—A 20-page guide of direct interest to power and maintenance engineers on "How to Select a Boiler" has been released by Cleaver-Brooks Company. The booklet, complete with over thirty illustrations and graphs, is in handy 5-inch by 7¼-inch format. It covers such topics as First Cost vs. Operating Costs, Selecting the Right Fuel, How to Save on Construction Costs, How to Solve the Low-Head Room Problem, the Packaged Boiler vs. the Built-Up Boiler, Boiler Design Standards, Burner Efficiency, and many other subjects.

(Circle 16 in Readers' Service Dept.)

TRANSFORMERS—PCA Electronics, Inc., has published a 24-page catalog titled "Pulse Transformers" and is designed to assist engineers in the application of transformers to their specific needs. Complete with many tables, charts, and schematics this manual covers a brief history of low-level pulse transformers, their measurements, specifications, applications, interchangeability, dielectric ratings, manufacturing, and other data.

(Circle 17 in Readers' Service Dept.)

GLASS DOORS—A new 8-page catalog in three-colors gives complete information on the two aluminum lines of Miller Sliding Glass Door Co., Inc. It shows the #250 Series for single glazing, and the #1000 Series which permits interchangeable glazing of 1" dual, ⅝" dual or ¼" single glass. Shop or field glazing—as well as interchange ability of glass without disturbing the framing installation—are special features of the #1000 Series. The catalog also shows a Miller door successfully passing the rigorous "Water Infiltration Test" at the new Sliding Glass Door & Window Institute Test Facility at Santa Maria, Calif. A unique feature of the catalog is the ½-size detail sheet which is perforated to permit easy removal for architectural tracing, and which contains suggested specifying data to save time and space in specification writing.

(Circle 18 in Readers' Service Dept.)

STAGELIGHTING—A stagelighting handbook for engineers and architects has been published. The 28-page manual serves as a guide to planning and designing modern stagelighting installations for theatre, hotel, school and church. The handbook is divided into two sections and features many specially prepared illustrations. The first section is titled "Planning the Auditorium and Stage" and includes ten subject headings from "Acting Areas" to "Special Problems." The second section is titled "Lighting the Stage," and covers such subjects as required circuits, stagelighting layout, power distribution systems and switchboard design.

(Circle 19 in Readers' Service Dept.)

ALUMINUM—Design information on architectual applications of aluminum is available in a brochure offered by the Metals Division, Olin Mathieson Chemical Corporation. The 12-page booklet contains a detailed listing of the properties of architectural aluminum alloys and their use in both standard and basic mill products as building components and materials. A special section describes the varieties of special finishes available with aluminum, their appearance and how they are obtained.

(Circle 20 in Readers' Service Dept.)

SOILS ENGINEERING—Soils engineering, its purpose and its scope, is the subject of a 16-page report recently issued by Mobile Drilling, Inc. Entitled "Men Build Highways—Drills Make It Profitable," the report explains how this relatively new science is providing roadbuilding contractors and state highway departments with much valuable soil information. The reader is taken step by step through a typical sub-surface exploration project including drilling, sampling and testing. How the soil data thus obtained is used by the contractor as a guide to sound bidding and job planning is covered in detail. The article is profusely illustrated with charts and graphs as well as on-the-job photos.

(Circle 21 in Readers' Service Dept.)

LUBRICATION—A 32-page catalog published by Lincoln Engineering Company has been announced. It describes a complete line of lubricant application equipment, fittings and accessories. Included are descriptions of completely automatic centralized systems, semi-automatic and manual methods of lubricating machines. In addition there are such fittings and accessories as: air couplers, hose, filters, air gauges, valves and pressure switches —in fact, all equipment necessary to automate or modernize a lube program is cataloged. Application can be made on any kind of machine that has a bearing surface (rotating, sliding or reciprocating) which requires a lubricant.

(Circle 22 in Readers' Service Dept.)

These listings are informational only and are not an endorsement of the products, nor of the manufacturer's claims. To receive any of the new literature described in this column, merely circle the item number in the Readers' Service Dept. and mail to AMERICAN ENGINEER.

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Pres. Dunn Reminds Members To Return Ballots Promptly

- Deadline for Counting Is February 23
- More Fund Drive Contributions Needed

"By now all members have received their ballots from national headquarters which will enable them to select their officers for the coming administrative year, as well as to approve a constitutional change which will allow the Society to increase dues $3 per member for the calendar year 1960," Dr. Clark A. Dunn, NSPE president, said at the time the AMERICAN ENGINEER went to press.

"I take this opportunity to remind all members that their ballots must be returned by February 23 to national headquarters in order to be in time for counting. Again, it is to be sincerely hoped that all members will vote and that all will recognize the financial situation in which the Society finds itself and will, therefore, sanction the proposed dues increase," the Society official added.

"Once again," Dunn emphasized, "I feel I must warn all members that the dues increase, even if approved, will not help in financing much needed programs during 1959. The dues increase will not be effective until 1960 and therefore the Society must depend upon the fund raising campaign now being conducted in order to maintain present programs throughout this year."

In a letter to all members the Society's chief executive pointed out that the fund drive was still very much active and that every member should make an effort to contribute even if the amount be small. In his letter, President Dunn made the following three points:

"First, NOVEMBER 28 WAS NOT A CONTRIBUTION DEADLINE: This date was set up as a cutoff for résumés to be used in selecting an "Ambassador." Your contribution to this campaign is welcome at any time.

"Second, THE CAMPAIGN RESULTS TO DATE HAVE BEEN GOOD: It is encouraging that 4,500 members have contributed a total of nearly $50,000 to continue effective presentation of our views to the public, industry and government; advancement of professional concepts and respect for our profession; research; scholarship programs; and many other programs which can only be met to the degree that this voluntary fund is supported.

"Third, THIS MONEY IS NOT YET ENOUGH TO DO THE JOB: We still need contributions from you who have not yet sent in your checks—for a minimum of one dollar for each year you have been a registered professional engineer. Won't you take another hard look at the problem we face? It is unfair for the ten per cent who have contributed so far to carry the burden for all of us. *Something* from *every* member would assure continuation of all our needed programs."

NSPE 'Ambassador' To Be Announced At Winter Meeting

Announcement of the NSPE "Ambassador" — selected from résumés submitted in conjunction with the Voluntary Fund Campaign—will highlight the winter meeting of the Society, February 19-21, in Birmingham, Alabama.

At the February 20 banquet, NSPE members will hear a talk by

Arthur V. Wiebel

Arthur V. Wiebel, president of the Tennessee Coal & Iron Division, United States Steel Corporation.

Mr. Wiebel, a graduate of Carnegie Institute of Technology, is a registered professional engineer and extremely active in civic affairs at the local and state levels in Alabama.

A panel of judges is currently going through the hundreds of résumés which have come into the national headquarters in an effort to select the one engineer who, along with his wife, will be sent as a goodwill ambassador to visit professional engineering societies in other countries, as well as outstanding engineering and scientific installations.

The opening dinner, which is to be presided over by President Clark A. Dunn, is scheduled for seven p.m. on February 19 in the Terrace Room of the Dinkler-Tutwiler Hotel. Dr. John M. Gallallee, president emeritus of the University of Alabama, will give the welcome address.

The three-day session will kick-off the 1959 Engineers' Week ob-

Thoughts on Professionalism...

By **PAUL H. ROBBINS, P.E.**
NSPE Executive Director

Science and Engineering: Their Interdependency

THERE is little question that engineering and science are and will continue to become increasingly interdependent. The tremendous technical strides of the last decade and the immensity of the emerging advances of the space age will require both the scientific and engineering groups to be more fully informed about each other. Scientific knowledge, if it is to be used for the benefit of the peoples of the world, will need the practical application of engineers; and engineers will have to be better informed on the basic scientific knowledge now being recorded.

AT the recent meeting of the American Association for the Advancement of Science in Washington, which someone called "a smorgasbord of science," it was very evident in many of the discussions that science is progressing because engineers are able to take the scientific discoveries and apply them to machines, vehicles, processes, and procedures by which further scientific advances can be made. While we are obtaining quantities of scientific information from our space problems we are able to make these probes because engineers are able to design the mechanisms for launching, directing, transmitting information, and recording results.

THE College-Industry Conference held at the end of January under the sponsorship of the Relations-with-Industry Division of the American Society for Engineering Education also took cognizance of the developing interdependency by discussing the question of the extent to which engineering education of the future will have to be altered to provide engineers with a more extensive scientific base. NSPE representatives played an active part in both of these meetings, and the Silver Anniversary meeting of NSPE in June will have this as a major subject of discussion.

THIS growing interdependence, however, is presenting another problem for the engineering profession. One of the greatest problems of the profession has been that of identification. It has been pointed out on numerous occasions that as the profession has gained more recognition and prestige there have been those who have a product or a service to which they wish to add stature by identifying it as engineering. Fortunately, the increasing identification of registration and its legal qualifications, as well as the increasing need to use engineers at their highest potential, has done much to identify the qualified members of the profession.

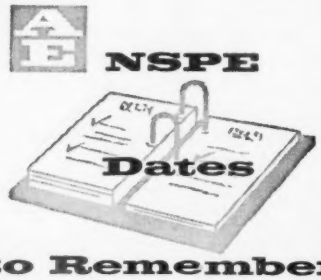
ENGINEERS must now guard that they do not lose their identity in the growing tendency to classify both scientists and engineers in the broad fields of science and technology. We can, and must, continue to alert the public to the important role of the engineer in making our scientific effort possible. Engineers' Week provides us with one such opportunity. While the dramatic reference of the times is to space travel and exploration and this provides the profession with a vehicle to dramatically portray its role in the headlines of today, we should, nevertheless, make it clear that the engineer with his practical applications of scientific knowledge is making an important contribution shoulder to shoulder with the scientist.

servance. Scheduled on the meeting program are special showings of the one-minute television films and a showing of the 15-minute radio program, "Engineering . . . for the Age of Space."

Varied social activities have also been planned for members and their wives.

All news for the "With the Auxiliaries" column should be sent directly to Mrs. Garvin H. Dyer, 10011 East 36th St., Independence, Mo.

All other state society and chapter news should be sent to the AMERICAN ENGINEER *immediately after the events take place.* And if photographs are taken, be sure and send them along too!



to Remember

Idaho Society of Professional Engineers—Annual Meeting, February 5-7, 1959, Boise Hotel, Boise, Idaho.

Nebraska Society of Professional Engineers—Annual Meeting, February 12, 1959, Lincoln Hotel, Lincoln, Nebraska.

National Society of Professional Engineers—Winter Meeting, February 19-21, 1959, Dinkler-Tutwiler Hotel, Birmingham, Alabama.

New Mexico Society of Professional Engineers—Annual Meeting, February 22, 1959, Alvarado Hotel, Albuquerque, New Mexico.

Iowa Engineering Society — Annual Meeting, February 24-25, 1959, Ft. Des Moines Hotel, Des Moines, Iowa.

Minnesota Society of Professional Engineers—Annual Meeting, February 25-27, 1959, Pick-Nicollet Hotel, Minneapolis, Minnesota.

Wyoming Society of Professional Engineers — Annual Meeting, February 26, 1959, Laramie, Wyoming.

Tennessee Society of Professional Engineers — Annual Meeting, February 27-28, 1959, Patten Hotel, Chattanooga, Tennessee.

Kansas Engineering Society—Annual Meeting, February 26-28, 1959, Lamer Hotel, Salina, Kansas.

Ohio Society of Professional Engineers—Annual Meeting, March 19-21, 1959, Commodore Perry Hotel, Toledo, Ohio.

Nebraska Society of Professional Engineers—Annual Meeting, March 21, 1959, Sheraton Fontenelle Hotel, Omaha, Nebraska.

National Society of Professional Engineers—Annual Meeting, June 17-20, 1959, Commodore Hotel, New York, New York.

Membership Drive

The Nassau County Chapter of the NYSSPE has opened a new membership drive to retain the gavel awarded to them for the best increase in New York State. NYSSPE Pres. Leigh St. John is shown presenting an 'Engineers Creed' and NSPE pin to new member J. H. Peters.

Correction . . .

The officers of the Tulsa Chapter, Oklahoma SPE, were incorrectly identified in the January issue, page 43, as being the officers of the Oklahoma State Society. The AMERICAN ENGINEER regrets this error.

Lorain County Society Holds Ladies' Night

The Lorain County Society of Professional Engineers, an affiliate of the Ohio SPE, entertained their wives with an evening of dinner and dancing recently. Thirty-two couples attended the affair.

"An Inside Look at Russia" was the subject of a talk given by Rev. Glenn Warner, guest speaker for the evening.

P.E. PUBLICITY CHAIRMEN

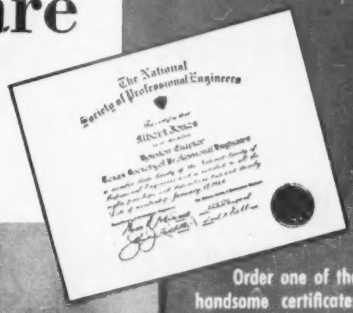
YOU have a date for MARCH 2!

That's the time to send your Engineers' Week story to the *American Engineer*.

As usual, space will be limited but we will give as wide coverage as possible. So get the news of the week's outstanding events in the mail EARLY.

MARCH 2 is the day to do it!

certificates and emblems are available

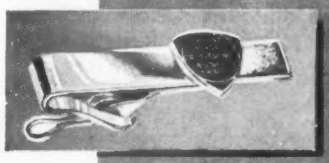


Order one of the handsome certificates showing your NSPE affiliation for your office wall.

The beautiful Society emblem is available in several styles. See coupon below.

The Professional Engineer insigne shown above is available styled as cuff links. Can also be ordered in large 3" size as a metal automobile emblem.

The emblem mounted as a tie chain makes a perfect gift.



The emblem worn as a tie clasp is distinctive jewelry for any professional engineer member.

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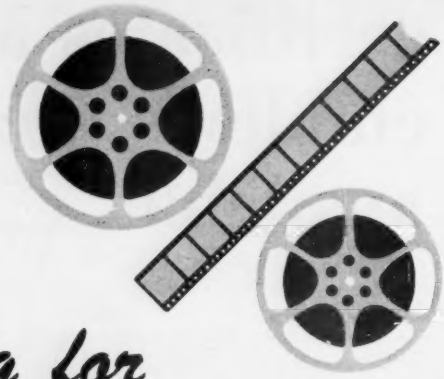

"Building for Professional Growth"

Here is a film covering the activities of the National Society of Professional Engineers at the chapter, state, and national levels. A milestone in the NSPE public relations program, "Building for Professional Growth" is a filmed presentation on the values and benefits of Society membership. Activities covered in the film include NSPE efforts in registration; research projects such as the Income and Salary Survey, the Professional Engineers Conference Board for Industry reports; legislative cooperation; National Engineers' Week, and other programs. Also included are scenes from actual chapter, state, and national level meetings.

"Building for Professional Growth" can be shown on any 16mm sound projector. Reservation requests should be made for three choices of dates. Notification of available date will be sent from NSPE headquarters immediately after each reservation request is received.

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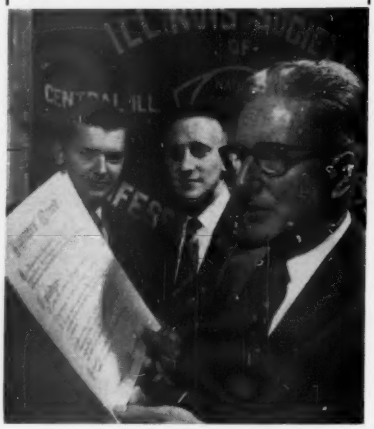

Two newly-registered Illinois professional engineers Lawrence C. Auby, Jr., left, and Chester G. Wells, center, discuss the Engineers Creed of Ethics with Frank Edwards, president of the Illinois SPE. Auby and Wells were among thirty-three honored at the second annual meeting of the Capital, Champaign County and Central Illinois Chapters.

SUBJECT LISTING OF NSPE PUBLICATIONS

(Unless otherwise indicated publications listed below are FREE and may be obtained by writing to NSPE, 2029 K Street, N.W., Washington 6, D. C.)

CHAPTER ACTIVITIES

Monographs outlining various chapter functions have been prepared for the use of chapters: **Helping the Young Engineer, Ladies Auxiliaries, Promote Ethical Practice, Chapter Publications, Functional Group Activities, Meetings, Fellowship, Attendance, Public Relations, Education—Key to the Future, Chapter Evaluation and Scoring System, and Indoctrination Conference for Chapter Officers and Committees.**

Welcome Mr. President—An informative booklet outlining organizational functions and suggestions for chapter presidents.

COMMUNICATIONS

***How to Improve Engineering-Management Communications**—Executive Research Survey Number One. Based on a survey of more than 300 companies employing engineers, this report contains information on engineering-management relations with respect to the lines of communication between engineers and management. Price $1.00 Members. $2.00 Non-members.

COMPETITIVE BIDDING

About Competitive Bidding—Reprint from American Engineer (NSPE Believes).

Competitive Bidding for Professional Services—NSPE Professional Policy Statement.

Recommended Procedure for Negotiating Engineering Contracts—NSPE Professional Policy Statement.

CONSULTING ENGINEERS

So You Want to Open a Consulting Office—Series of articles dealing with problems faced in opening a consulting office: **By Way of Qualifications**—John B. McGaughy, P. E., **Operating Your Practice**—Alfred J. Ryan, P. E., **Ethical Problems**—Francis S. Friel, P. E., Reprints from American Engineer. 20¢ each article—3 for 50¢.

CORPORATE ENGINEERING PRACTICE

Corporate Professional Practice vs. Individual Professional Practice—The Special Committee on Registration Law, NYSSPE. Reprint from American Engineer.

Should Corporations Practice Engineering?—Ronald B. Smith, P. E. and V. George Terenzio, P. E. Reprint from American Engineer. A discussion of the pros and cons of the issues involved in the debate over corporate practice of engineering.

CREED

Engineers' Creed—Suitable for distribution—free; for framing—50¢ each.

EMPLOYMENT PRACTICES

Criteria for Professional Employment of Engineers—Adopted by NSPE, June, 1956. 25¢ each.

Engineering Employment Practices Newsletter—Published monthly by NSPE; available to members upon request.

Survey Report—Engineers Employed by Private Practitioners—Covers salaries, hours, fringe benefits, etc., of engineers employed by consultants. Price 50¢ Members. $1.00 Non-members.

ETHICS

Canons of Ethics—Suitable for distribution—free; for framing—50¢ each.

Ethics for Engineers—Canons of Ethics, Creed, and Rules of Professional Conduct.

FEE SCHEDULES

Recommended Grades, Duties, Responsibilities and Qualifications for Pre-Professional and Professional Positions—Adopted by NSPE, June, 1952.

Report on Fee Schedules—Revised October, 1956. A study of the Salary and Fee Schedule Committee of NSPE bringing together various schedules of fees and related practices of engineers in the consulting field.

FUTURE OF ENGINEERS

Engineers for the Future—Reprint from American Engineer (NSPE Believes).

If I Were a Young Engineer Today—Reprint from American Engineer.

GOVERNMENT

Engineers in Federal Government—Reprint from American Engineer (NSPE Believes).

Our Function in Governmental Liaison—Reprint from American Engineer (NSPE Believes).

INDUSTRIAL RELATIONS

A Professional Look at the Engineer in Industry—NSPE Engineer-in-Industry Committee. A major publication of vital importance delving into all phases of the professional and economic status of that group which comprises the largest number of engineers in any functional field. Price $1.50 Members. $3.00 Non-members.

Professionalism or Unionism—Facing the Issue—Past President T. Carr Forrest, Jr., P. E. A discourse on the aspects of unionism for the professional. Reprint from American Engineer.

The Professional Engineer in Industry—Reprint from American Engineer (NSPE Believes).

The Professional Union—A Contradiction—Past President Clarence T. Shoch, P. E. A discussion of the development of engineers' unions and the reasons why unionism is incompatible with professionalism.

Criteria for Professional Employment of Engineers—Adopted by NSPE, June, 1956. 25¢ each.

Engineering Employment Practices Newsletter—Published monthly by NSPE; available to members upon request.

Engineering Team (The)—Reprint from American Engineer (NSPE Believes).

Professional Responsibility vs. Collective Bargaining—NSPE Professional Policy Statement.

Tabulation of Unions Representing Engineers and Technical Employees—A compilation of twenty-eight collective bargaining units which predominantly represent engineers, scientists and/or technicians. Also shown are the name of the employer whose employees are represented, the total number of employees represented, the number of dues-paying members, the number of professional employees among those represented and the number of nonprofessional employees represented. Price 50¢ Members. $1.00 Non-members.

***Career Satisfaction of Professional Engineers in Industry**—Latest in a series of Executive Research Reports on employment and professional problems concerning engineers in industry. Price $1.50 Members. $3.00 Non-members.

LEGISLATION

Legislative Bulletin—Published monthly by NSPE; available to members upon request.

MANPOWER

***How to Attract and Hold Engineering Talent**—Executive Research Survey Number Three. This report reflects the experience of more than 200 companies which employ engineers and attitudes of 1,400 individual engineers who are employed in industry. Price $1.00 Members. $2.00 Non-members.

***How to Improve the Utilization of Engineering Manpower**—Executive Research Survey Number Two. This report pools the experience of more than 495 companies employing engineers on the subject of utilization of manpower. Price $1.00 Members. $2.00 Non-members.

MEMBERSHIP PROMOTION

Every Man a Debtor—Sixteen-page booklet explaining NSPE organization, programs, activities and objectives.

Membership Kit—This kit is available to membership chairmen and contains a general outline of membership campaign techniques and sample materials. Any of the publications listed in this outline are generally available for distribution to membership promoters as membership mailing pieces.

NSPE PHILOSOPHY

Engineering Societies of America—Paul H. Robbins, P. E., executive director, NSPE. Describes organization, programs, activities and objectives of NSPE. Reprinted from G-E Review.

Is Our Registration Requirement Limiting Membership?—Reprint from American Engineer (NSPE Believes).

Why a Professional Society?—Reprint from American Engineer (NSPE Believes).

NATIONAL SECURITY

Engineering Profession in National Security (The)—NSPE Professional Policy Statement.

ORGANIZATION

Model Constitution for Ladies Auxiliary Chapters.

Model State Society Constitution.

NSPE's Constitution and Bylaws.

POLICIES, NSPE

Professional Policies—Compilation of all present NSPE policies as adopted by the Board of Directors.

Administrative Policies—Compilation of all present NSPE administrative policies. Includes Constitution and Bylaws, with a common subject index.

PROFESSIONAL DEVELOPMENT

Professionalism in Industry: The Dow Story—Case history of professionalism in industry. Reprint from American Engineer.

Conference Proceedings, Atlantic City, 1956—Management-Professional Employee Relations, Professional Status of Engineers in Government Employment, Teaching Professional Concepts in our Engineering Schools, 10¢ each.

Du Pont's Engineering Department Takes a Forward Look at Professional Development—C. H. Evans, P. E. Reprint from American Engineer.

PROFESSIONALISM

How a Professional Attitude Can Be Instilled in Engineers—Dean W. R. Woolrich, P. E. Reprint from American Engineer.

Significance of the PE Emblem.

PUBLIC RELATIONS

Engineers' Week—Reprint from American Engineer (NSPE Believes).

Our Public Relations Responsibilities—Reprint from American Engineer (NSPE Believes).

There's Nothing Wrong With Engineers—Reprint from American Engineer.

REGISTRATION

A Model Law for the Registration of Professional Engineers and Land Surveyors.

Is Our Registration Requirement Limiting Membership?—Reprint from American Engineer (NSPE Believes).

Next Step Registration—Informative pamphlet for engineering students and others on values and procedure for engineering registration.

Registration: Then, Now and Tomorrow—Frank H. Prouty, P. E., chairman, National Bureau of Engineering Registration. Reprint from American Engineer.

Professional Engineering Registration Laws—A compendium compiled by Alfred L. McCawley in cooperation with NSPE. Available from A. L. McCawley, Box 474, Jefferson City, Missouri—$8.75.

Q & A About Registration for Engineers in Industry—Presents in easy question and answer form, advantages, requirements and basic information about registration. Includes list of state registration boards and bibliography of refresher material for exams.

SALARY SURVEY

Professional Engineers' Income and Salary Survey—1952-1954-1956 statistics covering NSPE members. Price 50¢ each, Members. $1.00 Non-members.

STANDARD FORM OF AGREEMENT

Standard Form of Agreement Between Owner and Engineer for Professional Services—Price 5¢ each.

TRAINING

***How to Train Engineers in Industry**—Executive Research Survey Number Four. This report reflects the experience of more than 200 companies which employ engineers as well as of many individual leaders in the training field. Price $1.00 Members. $2.00 Non-members.

UNITY

Unity for Professional Action—Reprint from American Engineer (NSPE Believes).

Professional Organization of Engineers—Reprint from American Engineer.

VOCATIONAL GUIDANCE

Do We Have Enough Engineers?—Reprint from American Engineer (NSPE Believes).

Engineering . . . A Career of Opportunity—A general vocational guidance pamphlet.

Engineers for the Future—Reprint from American Engineer (NSPE Believes).

List of Accredited Engineering Schools—Reprint from ECPD Annual Report.

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* Order from and remit to Professional Engineers Conference Board for Industry, 2029 K St., N.W., Washington 6, D. C.

* Order from and remit to Professional Engineers Conference Board for Industry, 2029 K St., N.W., Washington 6, D. C.

UNITY

(Continued from page 38)

long as a "professional division" is considered.

The opinion has been expressed that we should not allow tax classifications to govern in our choice of a form of organization, but that we should set up what we think is best to accomplish what we wish to do and let the chips fall where they may. Generally speaking, no one can take exception to this logic. At the present time, however, we should do nothing that might prejudice the tax classification that the Founder Societies and United Engineering Trustees (UET) now enjoy, especially since the Founder Societies are seeking $5 million from industry and $3 million from members as contributions to the cost of the proposed new United Engineering Center contending that such contributions are tax-deductible to the donor because of the 501 (c) 3 classification of UET and the Founder Societies. Likewise, contributions and bequests are received from time to time by Engineering Societies Library and Engineering Foundation, which are departments of UET. This will continue indefinitely, we hope. The Board of Trustees of UET have applied for real estate tax exemption on the new building and have been told that this will depend upon the tax status of all the occupants of the building. Decision by the City of New York is being withheld at present. If real estate tax has to be paid on the new United Engineering Center, this will add materially to the costs of the Founder Societies.

EJC and ECPD are attempting at present to secure 501 (c) 3 classifications. Their merger into a joint council with the three divisions contemplated might prevent getting such classification for either or both, and might react on the classification of the Founder Societies and UET.

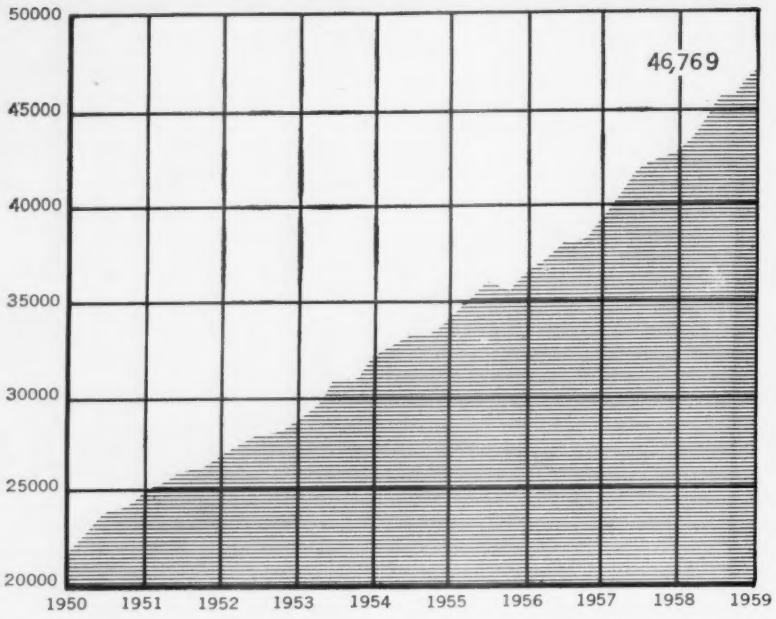
Under the Functional Plan, there would be no question about EJC and ECPD getting a 501 (c) 3 classification, although recent developments indicate that revision of the ECPD charter to describe its functions correctly would probably be necessary. The only society entitled to a 501 (c) 6 classification under the Functional Plan would be NSPE, which already has that classification because of its avowed objectives, and which has its own headquarters in Washington, D. C.

Recommendation

AIEE appeals most urgently that no action be taken, such as is proposed, that we believe will disturb the compatibility that has existed in EJC and ECPD.

It was in the spirit of fostering this compatibility that the Functional Plan was conceived by AIEE. A few years of trial of the Functional Plan would provide a background upon which to decide the desirability and preferable type of unity organization.—**End.**

NSPE Membership As New Year Begins: 46,769



Deadlines . . .

NSPE members are urged to return their official ballot by February 23 covering the election of 1959-60 officers as well as the proposed constitutional amendment pertaining to dues. Members are also reminded that the deadline is February 15 for returning the questionnaire for the 1958 Income and Salary Survey.

By Mrs. Garvin H. Dyer, Chairman of the Ladies Auxiliary Advisory Committee.

The wives of the South Dakota Society met in Rapid City in December and with the approval of the Society took preliminary steps in organizing, the final organization to take place at their annual meeting in May. Mrs. Noel Tweet was elected president.

Mrs. Hugh M. Nelson reports that the wives of the Reading Chapter of the Pennsylvania PSPE met in October at a tea held in the home of Mrs. Warren J. Birdegam and organized an auxiliary, "Wives of Professional Engineers." They are off to a fine start with sixty-seven charter members. Mrs. Luke F. Chelius was elected president.

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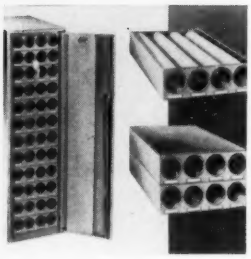
ROLL FILE — Item 30



A tube filing system for rolled prints, charts, drawings, maps, tracings, etc., has been introduced by Plan Hold Corp. It consists of modular steel encased Duro tubes in units of four tubes per Roll File. Roll File units measure twelve inches wide by four inches high by tube length. Currently offered in two tube lengths, 27 inches and 33 inches, these 2¾ inch inside diameter tubes offer the largest capacity tube file on the market, it is claimed.

WELDED GRATING — Item 31

Gold Nugget Welded Grating, which takes advantage of modern engineering design, has been announced by The Globe Co. The primary load bar provides considerably more strength with less weight. The bar is a miniature I-beam with all of the advantages of a true structural member. The grating is claimed to have: ⅜″ projection weld nugget for greater rigidity and strength; vertical alignment of the main load bars assured; *all* bars designed as load carrying bars, and anti-skid pattern.

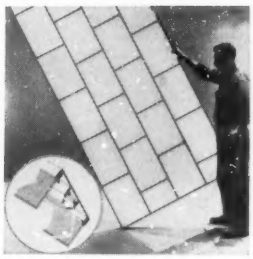
COPYING MACHINE — Item 32

A high-speed, high-quality diazotype whiteprint machine, known as Burning Copyflex Model 675, has been announced. According to the manufacturer, this is the first diazotype copying machine to embody recently designed features for reducing operation fatigue and increasing production. Intended for large scale black on white reproduction of engineering and architectural prints, the unit employs the fumeless, clean, quiet Copyflex diazotype process.

TROFFERS — Item 33

Almost 200 different sizes and types comprise the new Variform line of Fluorescent Lamp Troffers of Lighting Products Inc. This is a new, modular designed recessed luminaire 2′ x 2′ and 2′ x 4′ utilizing 2, 3, 4 or 6, 24″ or 48″ fluorescent lamps. These 2′ wide troffers are available with flush, snap-in, lay-in or flange construction and are designed to properly recess in any of over sixty different types of ceilings built by America's leading manufacturers. The firm also offers a reference guide showing the correct troffer for exact fit in any of the various ceiling constructions.

TRANSLUCENT PANELS — Item 34



A translucent building panel, comprising a fabricated plastic sandwich, is now available for numerous exterior and interior architectural and decorative treatments. Named Sanpan, the panels are assembled from fiberglass-reinforced polyester skins bonded to heavy extruded aluminum frames and internal grids. They are supplied in a variety of sizes and colors for standard or custom installations. Light in weight, the panels transmit comfortably diffused illumination.

PORTABLE DRILL — Item 35

The Geo-Drill Co. offers a portable Diamond Core Drill and accessory thin wall Diamond Bits for drilling close-tolerance holes and test cores in reinforced concrete and asphalt pavement. This compact unit can drill vertical, horizontal or angle holes and is used for maintenance applications and the installation of pipe, electrical conduit, air conditioning and ventilating systems as well as test cores. The drill column can be folded down to the base and the unit rolled on its two roller bearing wheels. Total weight, 190 pounds.

TORCHES — Item 36

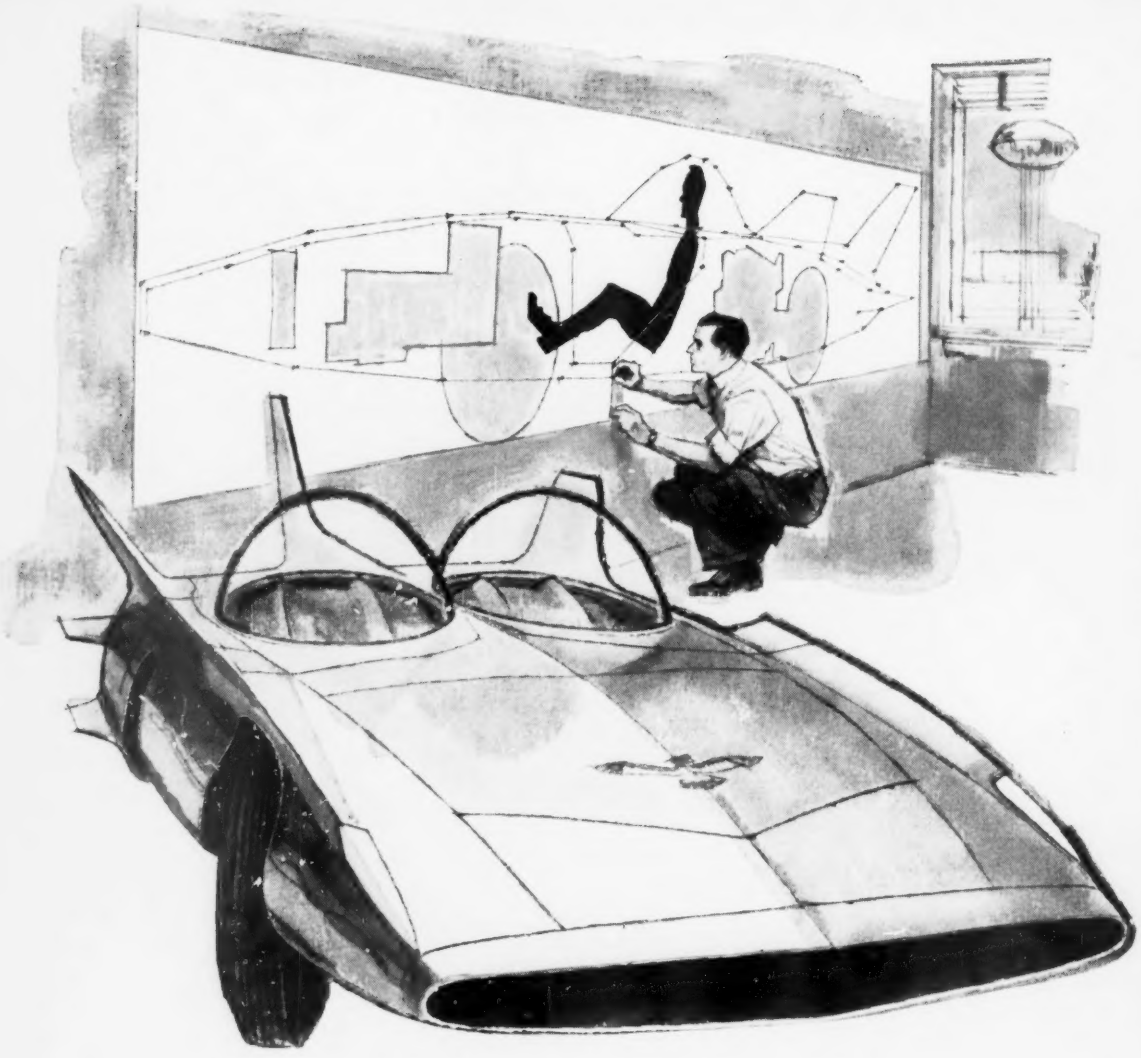
Air Reduction has announced new injection-type hand cutting torches designed for use with propane and natural gas. Known as the Airco 2000 Series, the torches have an "ease-on" cutting oxygen valve which allows smooth and gradual oxygen flow—helpful in hole piercing, rivet washing and stay bolt cutting. The torch head is a machined silicon bronze forging. For rigidity and strength the brass gas tubes are in a triangular arrangement.

TABLET T-SQUARE — Item 37

Tablet T-Square has been created for those who work at a desk and for whom going to a drawing table or keeping at the office desk a drawing board with a standard T-Square, thumb tacks, etc., for an occasional small drawing is inconvenient. The Tablet T-Square can be used against the edge of a standard 8½″ x 11″ tablet or pad of paper. Make your drawing on the top sheet, and simply tear the sheets off as the drawings are completed, says the manufacturer. No drawing board, thumb tacks or tape, or mounting the paper is necessary.

This column describes new products of general interest to professional engineers. For further information, circle the item number in the Readers' Service Dept. and mail to AMERICAN ENGINEER.

These listings are informational and are not an endorsement of the products, nor of the manufacturer's claims.



Imagination in motion

The motoring public refers to the Firebird as a "dream car." To General Motors it represents an experimental laboratory on wheels. But most important, to the automotive engineer it's a challenge to stretch the imagination in automotive technology.

Three Firebirds have been built—each more fabulous than the last. The third "bird" has an automatic guidance system, a unique dual-power system, and Unicontrol—a single lever that starts, stops and steers.

Advancements like these prove that engineers are continuing to meet the challenge of automotive technology. And, through their success, General Motors will continue to fulfill its promise of the future.

• Congratulations to Professional Engineers, especially during National Engineers Week. •

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